

**Missouri Department of Transportation**  
**Bridge Division**

**Bridge Design Manual**  
**Section 3.56**

**Revised 03/21/2003**

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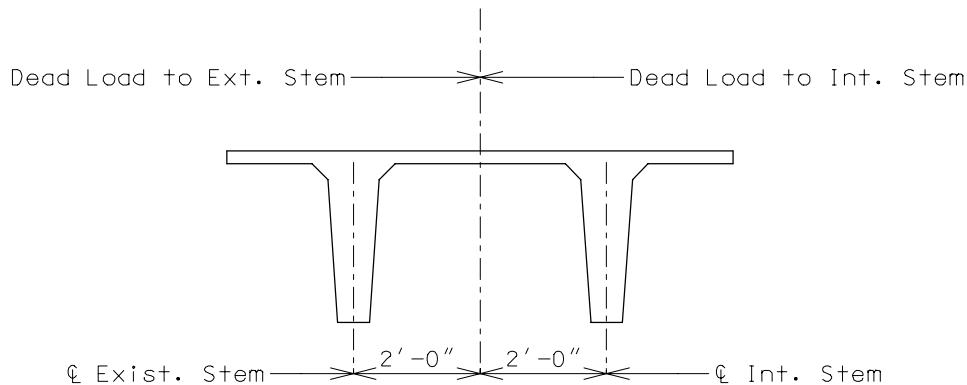
## GENERAL GIRDER AND SLAB DESIGN

## Superstructure

The cast-in-place slab is designed to carry only the live load of the bridge. One layer of steel is used in each direction of the cast-in-place slab with 1" clearance from bottom of slab. Reinforcing bars are  $f_y = 60$  ksi. A 1" integral wearing surface is deducted from effective slab depth for design.

The double tee girder flange is designed to carry the load of the cast-in-place slab, the flange weight and a 50 lb./sq. ft. construction dead load. (or a 300 lb. concentrated construction load per OSHA).

When determining the section properties of the double tee girder the center of gravity is based upon the total area (excluding corner fillets) of the entire exterior of interior girder and not on the individual stems. Moment of inertia and dead loads to each stem are figured to the center of the flange between the stems. The non-composite dead load of the external double tee girder is divided according to the following sketch.



The non-composite dead load of the interior double tee girder is divided evenly to each stem. A 9 lb./lin ft. dead load is added to the non-composite dead load of each stem for haunching. The non-composite dead load of C.I.P. slab, girder and haunch are based on simple spans from € to € Bearings.

The composite dead load of the safety barrier is divided 75% to the exterior stem of the exterior girder and 25% to the interior stem of the exterior girder. No dead load due to the barrier curb is added to the interior girder. The composite dead load for future wearing surface is 35 lb./sq.ft. or 3" of material. The composite dead load of safety barrier curb, and future wearing surface are based on continuous, composite spans from € to € Bearings.

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**GENERAL GIRDER AND SLAB DESIGN (CONT.)****Superstructure**

The live load design is based on HS20 or HS20 Military. The live load distribution factors are figured separate for exterior and interior Double Tee Girders. The assumption, that if the bridge is widened in the future the exterior girder then becomes an interior girder, does not control the design of exterior girder in the present Double Tee configurations. Live load distribution factors are equal to the average span/6 to determine wheel line reactions.

Composite sections are adjusted for the difference in modulus of elasticity of slab and girder by multiplying by the factor ( $E_{slab}/E_{girder}$ ). (\*) A 1" integral wearing surface is deducted for effective slab design.

Negative moment reinforcement is based on the amount required for the entire roadway width and not the amount required for each stem. The design is based on two equal spans using the BR200 program. The continuous span lengths are based on the distance from the C Bearing at End Bents to the C Interior Bent. The area of longitudinal reinforcing steel at the centerline of the intermediate bent is determined on the basis of a cracked section and 24,000 psi allowable stress. The area of reinforcing bars is provided by adding bars between the normal longitudinal bars.

Continuity is obtained at intermediate supports by extending and bending all strands to form interlocking right angle hooks and pouring a concrete diaphragm monolithic with deck slab encasing the prestressed girders with the flange cut back at diaphragm.

Camber is based on simple spans. A transformed moment of inertia is figured for the total exterior or interior double tee girder since the total girder is cambered at the same rate.

Reactions used for bearing design are based on simple spans and are taken from BR202 computer program.

Reactions (\*) used for the design of end bents and interior bents are calculated based upon lane loading or truck loading using two equal continuous span structures from the BR200 computer program.

Stirrup design follows design computations shown in Section 3.55 page 1.14-2 and are based upon the area of steel required by BR200 computer program.

Maximum horizontal curvature for Double-Tee structures is 3°. Outside flange edge of exterior girders on curved bridges is to be curved.

(\*) Calculations are made by computer program.

# Bridge Manual

**P/S Concrete Double-Tee Girders - Sec. 3.56**

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## GENERAL GIRDER AND SLAB DESIGN (CONT.)

**Superstructure**

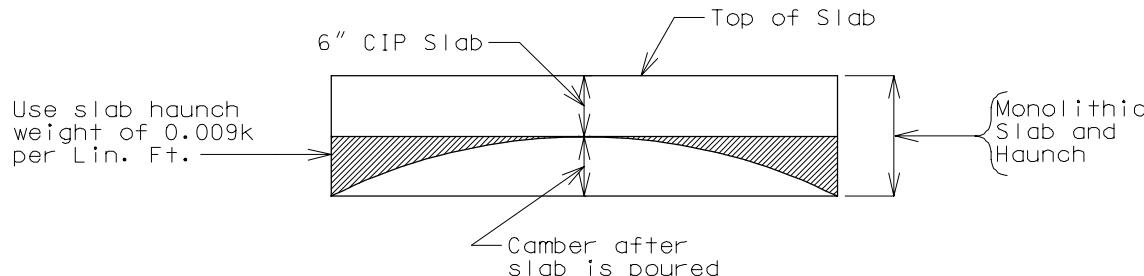
**TABLE OF BEARING PADS, STIRRUPS AND TEMPORARY STRESS BARS**

Prestressed Concrete Double Tee Girders	Type 16	Type 22	Type 30
Bearing Size (LxWxT) (60 Hardness) Integral End Bents	4 $\frac{1}{2}$ " x 7" x $\frac{1}{4}$ "	6 $\frac{1}{4}$ " x 6 $\frac{1}{4}$ " x $\frac{1}{4}$ "	9" x 5 $\frac{1}{4}$ " x $\frac{1}{4}$ "
(*** Laminated Neoprene Brdg. Pads - Intermediate Bents	5 $\frac{1}{2}$ " x 7" x $\frac{5}{8}$ "	7" x 6 $\frac{1}{4}$ " x $\frac{5}{8}$ "	10 $\frac{1}{2}$ " x 5 $\frac{1}{4}$ " x $\frac{5}{8}$ "
Stirrups for Shear	#4 at 12"	#4 at 18"	#4 at 21"
Additional Bars for Temporary Stresses at Top of Girder Section	2 - #5	2 - #5	2 - #5
Additional Bars for Each End of Stems	2 - #4 (*)	2 - #4 (**)	2 - #4 (**)

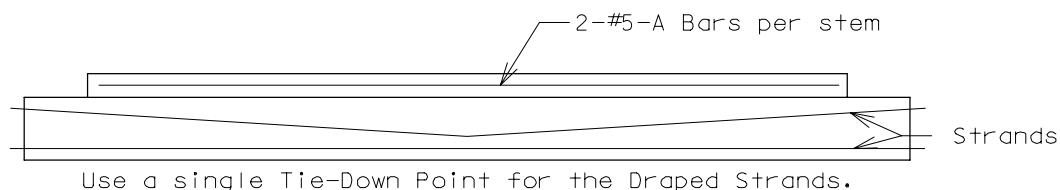
(\*) Place at 4" cts. between the first two regular stirrups in the end of the stems.

(\*\*) Place 4-#4 at equal spacing in the first space between the regular stirrups in the end of the stems. (Bar spacing not to be less than 3" on center.)

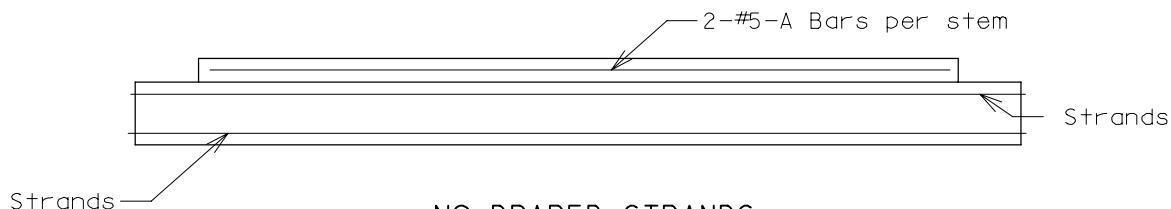
(\*\*\*) Bearing Pads are designed for maximum allowable compressive stress and should be checked for minimum Dead Load requirements.



**DETAIL OF HAUNCH**



**DRAPE STRANDS**



Note: Girders with no draped strands require one strand placed at top of girder (Inside face of girder). These strands shall be analyzed until new tables are issued.

GENERAL GIRDER AND SLAB DESIGN  
PRESTRESS LOSS COMPUTATIONS

Superstructure

$$f'c = 5,000 \text{ psi} \quad f_c = 0.4(4,000) = 1,6000 \text{ psi Est.}$$

$$f'ci = 4,000 \text{ psi}$$

Grade 270 low relaxation strands

$$f_{si} = 270 \text{ ksi}$$

$$f_{si} = 270 \times 0.75 = 202.5 \text{ ksi}$$

$$\left[ (SH) + \frac{(EST)}{E_{ci}} f_c + 5f_c + (5,000 - 0.08EST - 0.04(SH + CRc)) \right]$$

$$SH = 6,000 \quad 6,000$$

$$EST = \frac{29,000}{3,834} (1,600) = 12,102$$

$$CRc = 5(1,600) = 8,000$$

$$CRs = 5,000 - 0.08 (12,102) - 0.04 (6,000 + 8,000) = 3,471$$

$$\begin{array}{ll} \text{Total Loss} & 29,573 \text{ psi} \\ \text{Time dependent} & 29.573 \text{ ksi} \end{array}$$

SH = Shrinkage

EST = Elastic Strain

CRc = Concrete Creep

CRs = Steel Creep

(\*) CRs loss modified to approx. ACI loss formula

$$\text{Percent} = \frac{\text{Loss}}{f_{si}} = \frac{29.573}{202.5} = 14.6\% \text{ Total Loss}$$

$$Li = 1 - \sqrt{1 - Lt/202.5}$$

$$Li = 1 - \sqrt{1 - 29.57/202.5}$$

$$Li = 7.6\% \quad \text{Initial Loss}$$

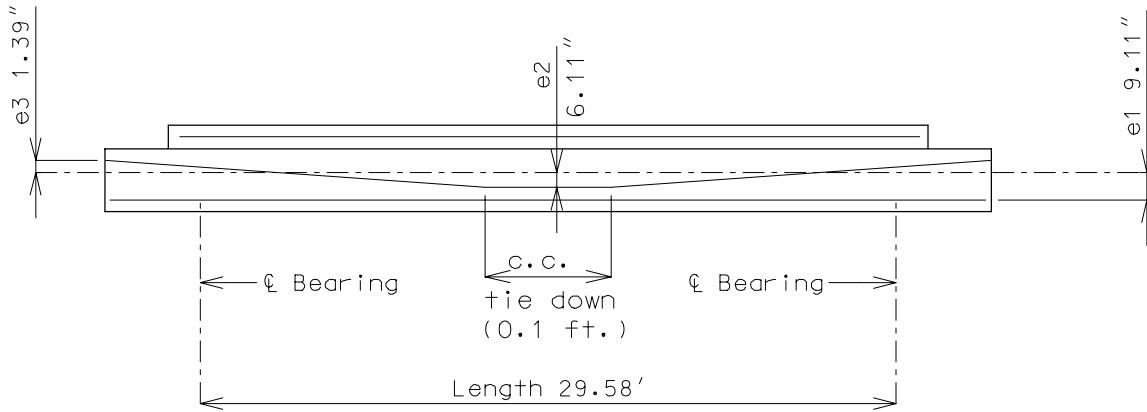
Total time dependent losses for double tee prestress girders is 29.57 ksi.  
Use 7.6% for initial loss and 7.6% for final loss for design.

$$202.5 \times 0.076 = 15.39 \text{ ksi} \quad 202.5 - 15.39 = 187.11 \text{ ksi}$$

$$187.11 \times 0.076 = 14.22 \text{ ksi} \quad 15.39 + 14.22 = 29.61 \text{ ksi} \approx 29.57 \text{ ksi}$$

**GENERAL GIRDER AND SLAB DESIGN  
PRESTRESS CAMBER**
**Superstructure**

References: Computer program BZ139B



Type 16 Strand Seq. 162 Span 31.0 Roadway 24'-10"

$$\left. \begin{array}{l} I = 7796. \text{ in.}^4 \\ (\text{Non-transformed}) \\ \text{Beam wt.} = 0.254 \text{ k/ft.} \end{array} \right\} \text{Resist uplift before beam is set on bent}$$

$$\left. \begin{array}{l} I = 8193.6 \text{ in.}^4 \\ (\text{Transformed}) \\ \text{Slab wt.} = 0.268 \text{ k/ft} \\ 6'' \times 41.5 \times 0.15 \\ \hline 144 \text{ haunch} \\ = 0.259 \\ 0.009 \\ \hline 0.268 \\ \text{Diaph. wt.} = 0 \end{array} \right\} \text{Use after beam is in place}$$

**GENERAL GIRDER AND SLAB DESIGN  
PRESTRESS CAMBER (CONT.)**

Superstructure

Creep Multiplication factor for deflection

$$\text{Mult. Factor} = \left[ 1 + (1 - e^{-\phi}) \right] = F_{CRP}$$

$$e = 2.7183, \quad \phi = E_{creep} \times E_f$$

$$E_i = 60,625 \sqrt{f'ci} \\ f'ci = 4,000 \text{ psi}$$

$$E_i = 3.834 \times 10^6$$

$$E_f = 60,625 \sqrt{f'cf} \\ f'cf = 5,000 \text{ psi}$$

$$E_f = 4.287 \times 10^6$$

$\epsilon_{creep} = (\epsilon_{20\text{yr}}) \times 1.8 \times (F_{vol-surf}) \times 0.4$   
(0.4) Use 40% based on 28 day creep at erection  
 $\epsilon_{20\text{yr}}$  from Figure 5 PCA Design P/S Girders  
 $\epsilon_{20\text{yr}} = 0.37$  using  $E_i$

$F_{vol-surf}$  from figure 7 PCA Design P/S Girders

$$F_{vol-surf} = 1.42 \quad \text{Type 16} \quad \frac{\text{Area}}{\text{Perimeter}} = \frac{243.75}{117.5} = 2.07 \text{ in.}$$

$$\epsilon_{creep} = 0.37 \times 1.8 \times 1.42 \times 0.4 = 0.378 \times 10^{-6} \\ \phi = 4.287 \times 0.378 = 1.62$$

$$F_{CRP} = \left[ 1 + (1 - e^{-\phi}) \right]$$

$$F_{CRP} = 1.80 = \left[ 1 + (1 - 2.7183^{-1.62}) \right]$$

Use 1.80 creep multiplication factor for all double tees.

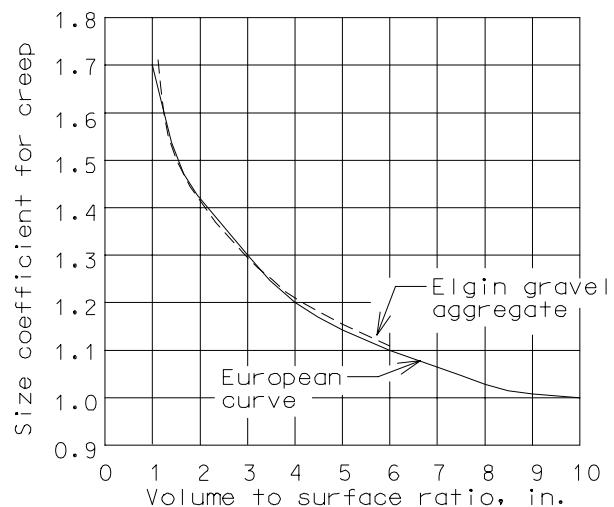


FIG. 7. CREEP VS.  
VOLUME-TO-SURFACE RATIO

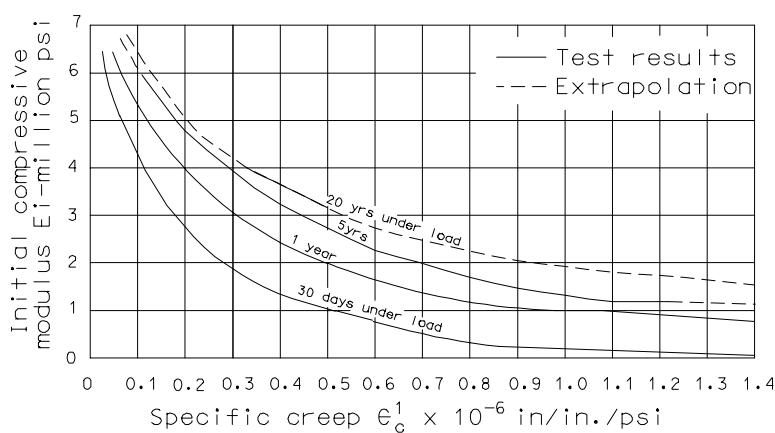


FIG. 5. PREDICTION OF BASIC CREEP FROM ELASTIC MODULUS

# Bridge Manual

## P/S Concrete Double-Tee Girders - Sec. 3.56

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### GENERAL GIRDER AND SLAB DESIGN PRESTRESS CAMBER (CONT.)

Superstructure

These formulae are used to determine the following:

Camber due to initial strand stress (inch)

Deflection due beam weight stress (inch)

Camber L/4 due strands, beam weight and 28 day creep (inch)

Deflection due to slab weight

Camber centerline due strands, beam weight, 28 day creep, slab and diaphragm (inch)

Formulas used:

$$\Delta = 144 \times 10^3 \times \left[ \frac{F_0 (e_1 (L^2))}{8EI_{NON}} + \frac{F_0 (e_2 + e_3)}{EI_{NON}} \left( \frac{L^2}{8} - \frac{a^2}{6} \right) - \frac{F_0 (e_3)(L^2)}{8EI_{NON}} \right]$$

$$(E = 0.060625 \sqrt{F'ci} \times 10^6) \text{ psi} \quad (a = [L - (\text{ft to ft tie downs})] \div 2) \text{ ft.}$$

Beam weight camber

$$\Delta_2 = \frac{5W_B (L^4)}{384EI_{NON}} (1728 \times 10^3)$$

$$(E = 0.060625 \sqrt{F'ci} \times 10^6)$$

Slab weight camber

$$\Delta_S = \left[ \frac{5W_S (L^4)}{384EI_{TRN}} + \frac{P(L^3)}{38EI_{TRN}} \right] (1728 \times 10^3)$$

$$(E = 0.060625 \sqrt{F'cf} \times 10^6)$$

$$\text{Total } \Delta \text{ at } \ell = (\Delta_1 + \Delta_2) F_{CRP} + \Delta_s$$

$$\Delta @ 1/4 = 0.7125 \quad (\Delta @ \ell)$$

$$\Delta @ 0.1 = 0.314 \quad (\Delta @ \ell)$$

$$\Delta @ 0.2 = 0.593 \quad (\Delta @ \ell)$$

$$\Delta @ 0.3 = 0.813 \quad (\Delta @ \ell)$$

$$\Delta @ 0.4 = 0.952 \quad (\Delta @ \ell)$$

Force straight strands

$$F01 = (\# \text{ straight strands}) \times [F0 - (L_{AVG} \times A_{STR})] \text{ kips}$$

Force draped strands

$$F02 = (\# \text{ draped strands}) \times [F0 - (L_{AVG} \times A_{STR})] \text{ kips}$$

$$F0 = 270 \times R_{MAX} \times A_{STR}$$

$A_{STR}$  = Area of strands (Sq in)

$FCT - F_{CRP}$  = Creep factor =  $1 + (1 - e^{-\theta})$

MAX FORCE- $R_{MAX}$  = Max prestress force ratio stress REL 0.7 LOWLAX 0.75

$E1D-e_1$  = Dist. centroid beam to centroid straight strands (in)

$E1D-e_2$  = Dist. centroid beam to low centroid draped at center of beam (in)

$E1D-e_3$  = Dist. centroid beam to up centroid draped at end beam (in)

$LGT-L$  = Length (ft.) ( $\ell$  Bearing to  $\ell$  Bearing)

$I$  = Moment of inertia (in.<sup>4</sup>)

$DIA-P$  = concentrated load (kips) Diaphragm

$BMW-T-W$  = Uniform beam load (kips/ft.)

$SLB-W$  = Uniform slab load (kips/ft.)

$L_{AVG}$  = Average loss initial and final =  $[(2 R_{INIT} - R_{INIT}^2) \times 0.5] \times 270 \times R_{MAX}$

$INIT/LOSS-R_{INIT}$  = Initial loss ratio (0.10) 5000 old, (0.1075) 5000 New, (0.08) 5000 LOW LAX.

GENERAL GIRDER AND SLAB DESIGN  
PRESTRESS CAMBER (CONT.)

Superstructure

Camber

Example Low Relax

$$F_0 = 270 \times 0.75 \times 0.153 = 31.0 \text{ kips}$$

$$L_{avg} = [(2(0.076) - (0.076)^2)0.5] \times 202.5$$

$$L_{avg} = 14.8 \text{ ksi}$$

or

$$L_{avg} = L/2 = 29.57/2 = 14.78 \text{ ksi}$$

$$a = (29.58 - 0.1)/2 = 14.74 \text{ ft.}$$

$$F_{01} = 4 \times [30.1 - (14.8 \times 0.153)] = 111.34 \text{ kips}$$

$$F_{02} = 2 \times [30.1 - (14.8 \times 0.153)] = 55.67 \text{ kips}$$

$$\begin{aligned} \Delta_1 &= 144 \times \left[ \frac{111.3 (9.11) (29.58)^2}{8 (3834) (7796)} + \frac{55.67 (6.11 + 1.39)}{(3834) (7796)} \left( \frac{29.58^2}{8} - \frac{14.74^2}{6} \right) \right. \\ &\quad \left. - \frac{55.67 (1.39) (29.58)^2}{8 (3834) (7796)} \right] \end{aligned}$$

$$\Delta_1 = 144 \times [0.00371 + 0.00102 - 0.000283]$$

$$\Delta_1 = 0.64 \text{ in.}$$

$$\Delta_2 = \frac{5 (0.254) (29.58)^4}{384 (3834) (7796)} (1728)$$

$$\Delta_2 = 0.146 \text{ in.}$$

$$\Delta_s = \frac{5 (0.268) (29.58)^4}{384 (4287) (8193.6)} (1728)$$

$$\Delta_s = 0.131 \text{ in.}$$

$$\Delta_{TOT} = (0.64 - 0.146) 1.80 - 0.1310$$

$$\Delta_{TOT} = 0.76 \text{ in. or } 3/4 \text{ inch}$$

$$\Delta@1/4 = 0.76 (0.7125) = 0.54 \text{ or } 9/16 \text{ inch}$$

GENERAL GIRDER AND SLAB DESIGN  
INITIAL PRESTRESS STRAND FORCE

Superstructure

Total No. of Strands Per Stem	Total P/S Force Kips Per Stem
1	31.0
2	62.0
3	93.0
4	124.0
5	155.0
6	186.0
7	217.0
8	248.0
9	279.0
10	310.0

Note: Shown in the table are the values of initial prestress force based on 31.0 kips/strand

Use low relaxation strands (1/2 round As = 0.153 sq. in.)  
0.75 jacking force with  $F_u = 270 \text{ ksi}$ .

$$\begin{aligned} 270 \times 0.75 &= 202.5 \text{ ksi} \\ 202.5 \times 0.153 &= 30.98 \text{ kips/strand} \end{aligned}$$

Use 31.0 kips

$$\begin{aligned} f'_c &= 5,000 \text{ psi} \\ f'_{ci} &= 4,000 \text{ psi} \end{aligned}$$

Concrete tension before losses  $7.5 \sqrt{f'_{ci}}$

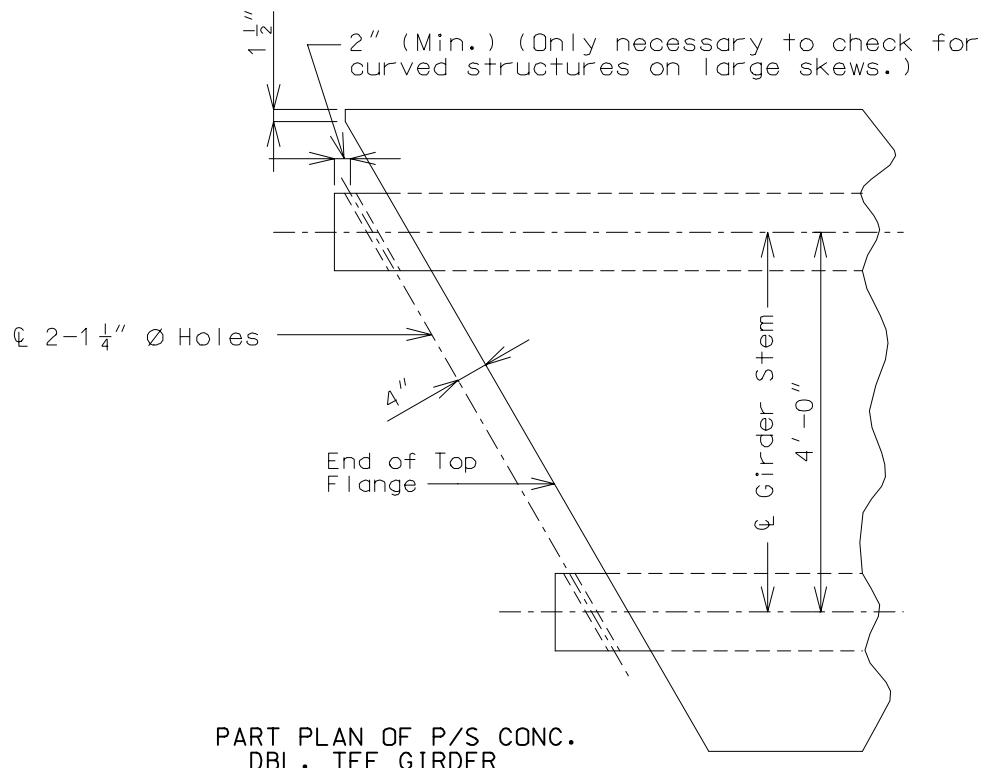
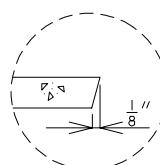
Concrete tension after losses  $6 \sqrt{f'c}$

Concrete compression before losses  $0.6f'_{ci}$   
Concrete compression after losses  $0.4f'c$

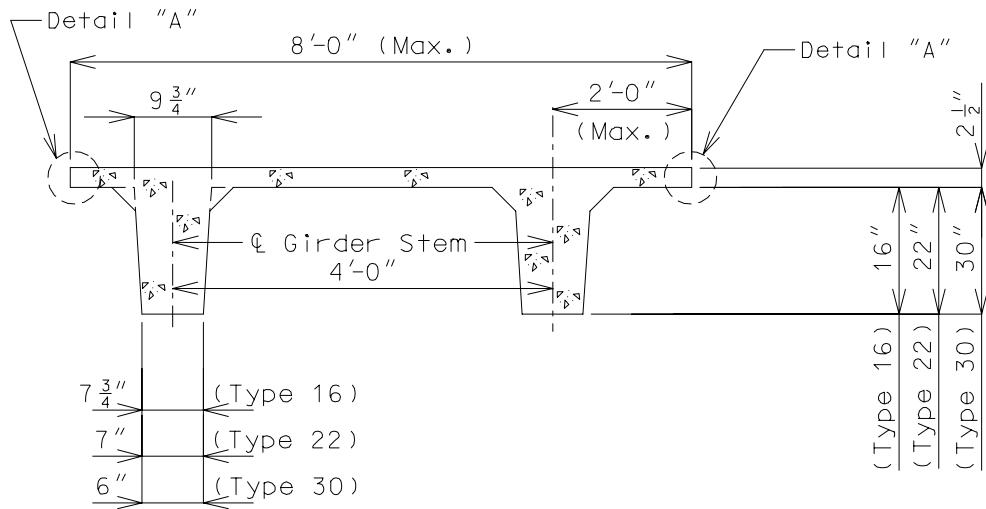
## GENERAL GIRDER AND SLAB DESIGN

## Superstructure

## GIRDER DIMENSIONS

PART PLAN OF P/S CONC.  
DBL. TEE GIRDER

DETAIL "A"

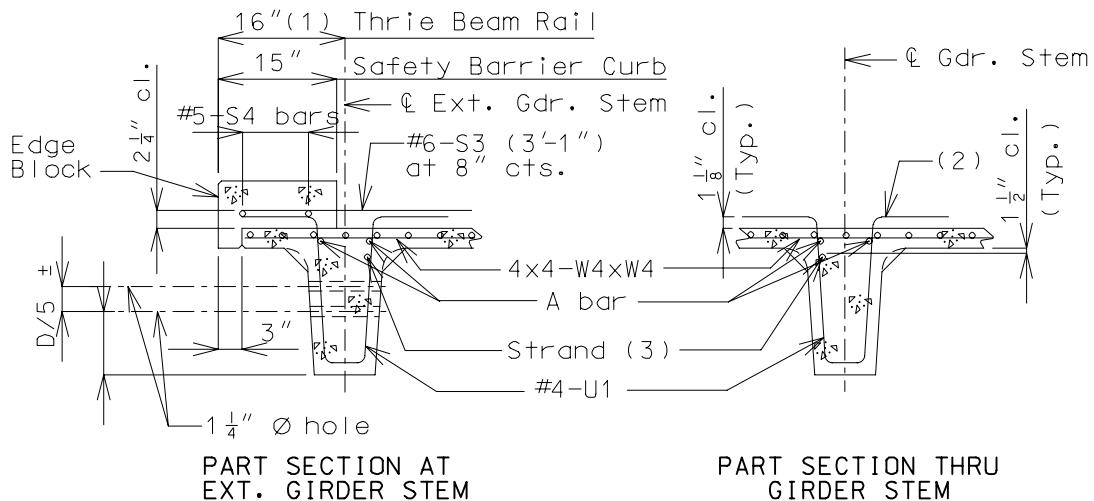


SECTION THRU P/S CONC. DBL. TEE GIRDER

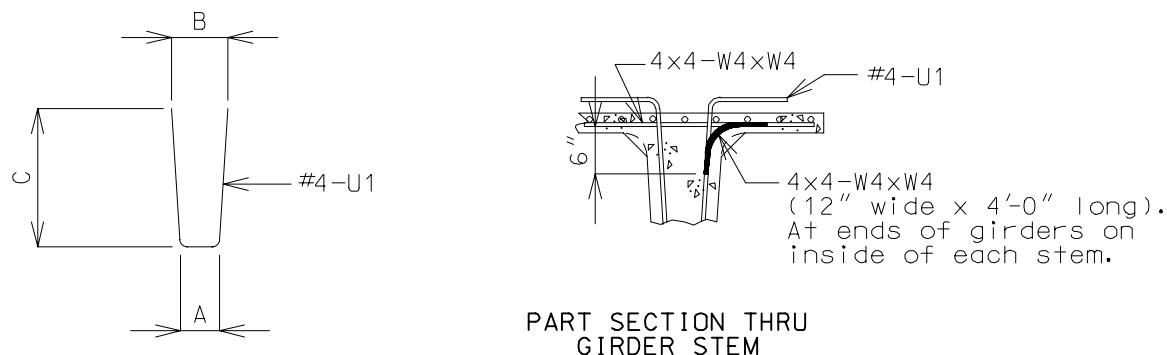
## GENERAL GIRDER AND SLAB DESIGN

## Superstructure

## GIRDER REINFORCEMENT



- (1) Varies for Curved Girder Structures (Max. 17-1/2")
- (2) May be bent anytime after concrete attains 3,000 psi compression strength.
- (3) Girders with no draped strands require one strand placed at top of girder (Inside face of girder). These strands shall be analyzed until new tables are issued.



Length	A	B	C	Total
Gdr. Type 16	5 $\frac{3}{4}$ "	9 $\frac{1}{4}$ "	2'-4 $\frac{1}{2}$ "	5'-1"
Gdr. Type 22	5"	9 $\frac{1}{4}$ "	2'-10 $\frac{1}{2}$ "	6'-0"
Gdr. Type 30	4"	9 $\frac{1}{4}$ "	3'-6 $\frac{1}{2}$ "	7'-3"

# Bridge Manual

**P/S Concrete Double-Tee Girders – Sec. 3.56**

**Page: 1.2-1**

**24'-10" ROADWAY**

**GIRDER SPAN LENGTH (HS20 & HS20 MILITARY LOADING)**

**Superstructure**

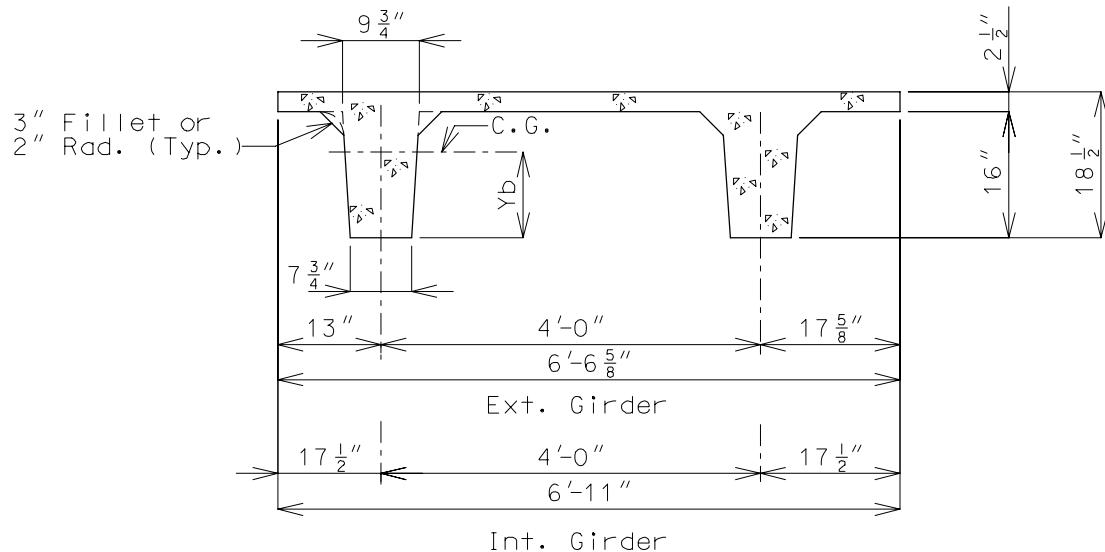
Span Length	Allowable Span Length For P/S Concrete Double-Tee Girder Spans					
	Type 30		Type 22		Type 16	
Span Length	Girder Seq. No.	Span Length	Girder Seq. No.	Span Length	Girder Seq. No.	
20'						
21'						
22'						
23'						
24'						
25'						
26'						
27'						
28'						
29'						
30'						
31'						
32'						
33'						
34'						
35'						
36'						
37'						
38'						
39'						
40'						
41'						
42'						
43'						
44'						
45'						
46'						
47'						
48'						
49'						
50'						
51'						
52'						

**Note:**

The maximum span lengths shown for P/S Double-Tee Girders are based on a minimum of 2-spans (continuous) being used. If one of these P/S Double-Tee Girders is used as one simple span, then the span lengths should be reduced from the maximum allowable span shown, and the girder design should be checked.

**24'-10" ROADWAY - BEAM TYPE 16 (4 GIRDER)**  
**SECTION PROPERTIES & STRAND ARRANGEMENT**

Superstructure



$$A = 476.6 \text{ sq. in.}$$

$$Y_b = 12.00 \text{ in.}$$

$$I = 15,291 \text{ in.}^4$$

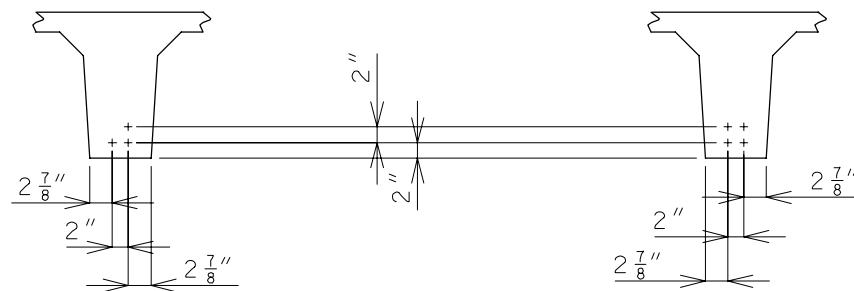
EXTERIOR GIRDER

$$A = 487.5 \text{ sq. in.}$$

$$Y_b = 12.11 \text{ in.}$$

$$I = 15,592 \text{ in.}^4$$

INTERIOR GIRDER

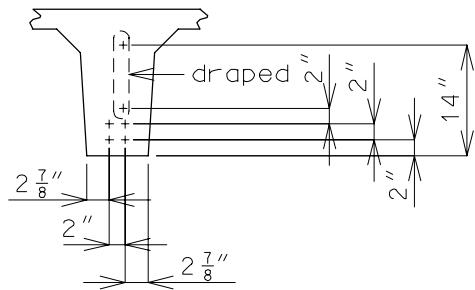


GIRDER SEQ. NO. 130  
 (3 STRANDS - 0 DRAPED)

GIRDER SEQ. NO. 140  
 (4 STRANDS - 0 DRAPED)

24'-10" ROADWAY - BEAM TYPE 16 (4 GIRDER)  
SECTION PROPERTIES & STRAND ARRANGEMENT (CONT.)

Superstructure



GIRDER SEQ. NO. 151  
(5 STRANDS - 1 DRAPED)

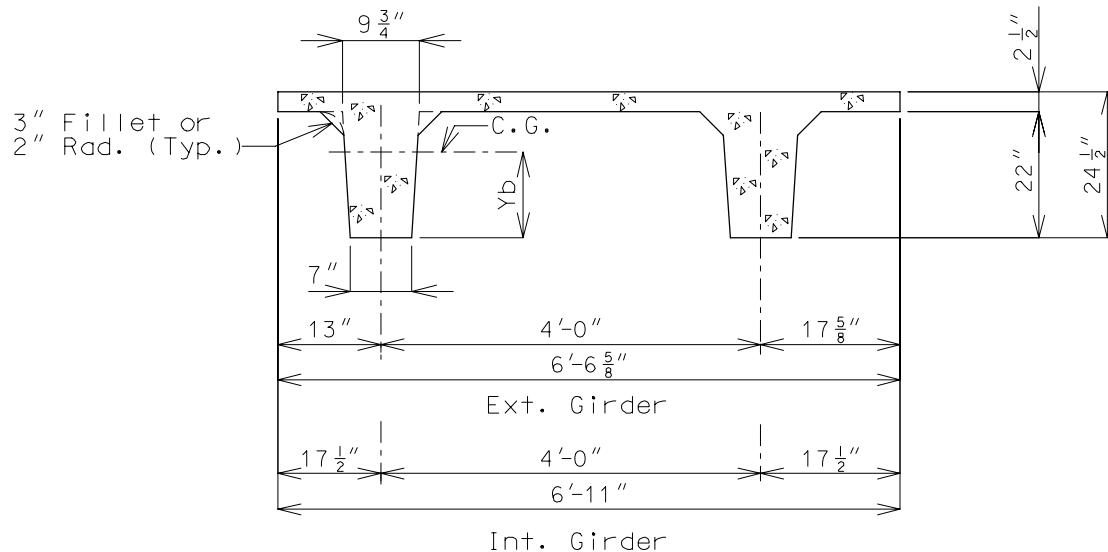
Note: Location of draped strands shown in top of stem  
are at end of girder and draped strands in bott. of stem  
are at ℥.





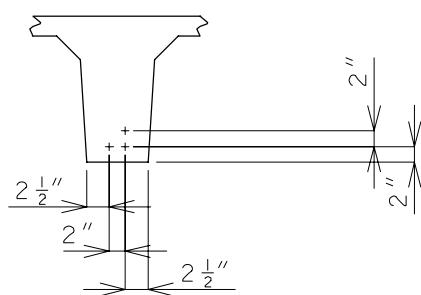
**24'-10" ROADWAY - BEAM TYPE 22 (4 GIRDER)**  
**SECTION PROPERTIES & STRAND ARRANGEMENT**

Superstructure



$A = 565.1$  sq. in.  
 $y_b = 15.65$  in.  
 $I = 32,223$  in.<sup>4</sup>  
**EXTERIOR GIRDER**

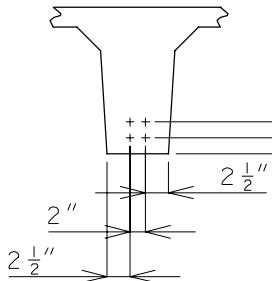
$A = 576.0$  sq. in.  
 $y_b = 15.80$  in.  
 $I = 32,848$  in.<sup>4</sup>  
**INTERIOR GIRDER**



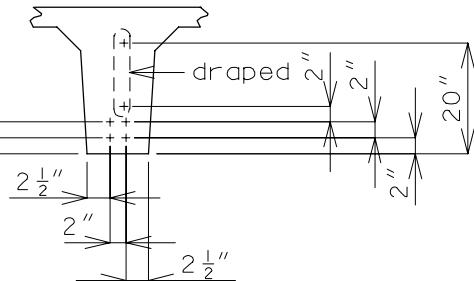
GIRDER SEQ. NO. 230  
(3 STRANDS - 0 DRAPED)

**24'-10" ROADWAY - BEAM TYPE 22**  
**SECTION PROPERTIES & STRAND ARRANGEMENT (CONT.)**

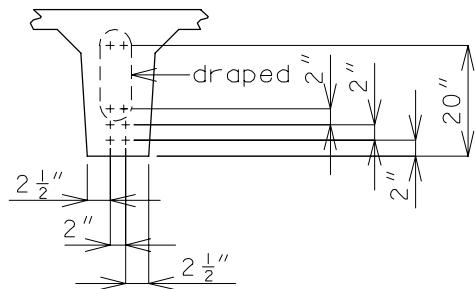
Superstructure



GIRDER SEQ. NO. 240  
 (4 STRANDS - 0 DRAPED)



GIRDER SEQ. NO. 251  
 (5 STRANDS - 1 DRAPED)



GIRDER SEQ. NO. 262  
 (6 STRANDS - 2 DRAPED)

Note: Location of draped strands shown in top of stem  
 are at end of girder and draped strands in bott. of stem  
 are at  $\frac{1}{4}$ .

## Bridge Manual

P/S Concrete Double-Tee Girders - Sec. 3.56

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24'-10" ROADWAY - BEAM TYPE 22 (HS20 & HS20 MILITARY) Superstructure  
GIRDER REACTIONS

Length Span Seq.	Girder Seq.	Dead Load Reaction, kips per stem		
		Interior Girder	Exterior Girder	
			Int. Stem	Ext. Stem
20'	230	6.47	7.00	8.25
21'	230	6.82	7.37	8.69
22'	230	7.16	7.75	9.13
23'	230	7.51	8.12	9.57
24'	230	7.86	8.49	10.01
25'	230	8.21	8.87	10.45
26'	230	8.55	9.24	10.89
27'	230	8.90	9.61	11.33
28'	230	9.24	9.99	11.77
29'	230	9.58	10.36	12.21
30'	240	9.93	10.73	12.65
31'	240	10.27	11.11	13.09
32'	240	10.62	11.48	13.53
33'	240	10.96	11.85	13.97
34'	240	11.32	12.23	14.41
35'	251	11.66	12.60	14.85
36'	251	12.01	12.97	15.29
37'	251	12.35	13.35	15.73
38'	262	12.69	13.71	16.16
39'	262	13.03	14.07	16.58

Reactions are DL1 + DL2 from BR202 (Simple Span).

# Bridge Manual

**P/S Concrete Double-Tee Girders - Sec. 3.56**

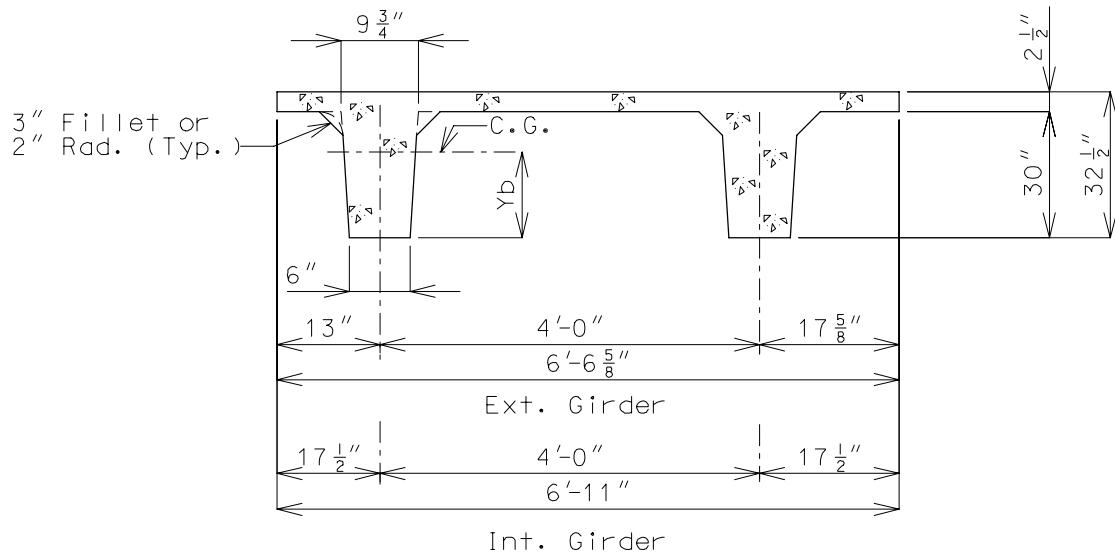
**Page: 1.2-9**

**24'-10" ROADWAY - BEAM TYPE 22 (HS20 & HS20 MILITARY) Superstructure  
GIRDER CAMBER**

Span Length & Bent	Girder No.	Interior Girder				Exterior Girder			
		Girder Camber without Slab		Girder Camber with Slab		Girder Camber without Slab		Girder Camber with Slab	
		1/2 pt.	1/4 pt.	1/2 pt.	1/4 pt.	1/2 pt.	1/4 pt.	1/2 pt.	1/4 pt.
20'	230	3/16"	1/8"	3/16"	1/8"	3/16"	1/8"	3/16"	1/8"
21'	230	3/16"	1/8"	3/16"	1/8"	3/16"	1/8"	3/16"	1/8"
22'	230	3/16"	1/8"	3/16"	1/8"	3/16"	1/8"	3/16"	1/8"
23'	230	1/4"	3/16"	3/16"	1/8"	1/4"	3/16"	3/16"	1/8"
24'	230	1/4"	3/16"	1/4"	3/16"	1/4"	3/16"	1/4"	3/16"
25'	230	1/4"	3/16"	1/4"	3/16"	1/4"	3/16"	1/4"	3/16"
26'	230	1/4"	3/16"	1/4"	3/16"	1/4"	3/16"	1/4"	3/16"
27'	230	5/16"	3/16"	1/4"	3/16"	5/16"	3/16"	1/4"	3/16"
28'	230	5/16"	1/4"	1/4"	3/16"	5/16"	1/4"	1/4"	3/16"
29'	230	5/16"	1/4"	5/16"	3/16"	5/16"	1/4"	5/16"	3/16"
30'	240	7/16"	5/16"	7/16"	5/16"	7/16"	5/16"	7/16"	5/16"
31'	240	1/2"	3/8"	7/16"	5/16"	1/2"	3/8"	7/16"	5/16"
32'	240	9/16"	3/8"	7/16"	5/16"	9/16"	3/8"	7/16"	5/16"
33'	240	9/16"	3/8"	1/2"	3/8"	9/16"	3/8"	1/2"	3/8"
34'	240	9/16"	7/16"	1/2"	3/8"	9/16"	7/16"	1/2"	3/8"
35'	251	3/4"	1/2"	5/8"	7/16"	3/4"	1/2"	5/8"	7/16"
36'	251	3/4"	9/16"	5/8"	7/16"	3/4"	9/16"	5/8"	7/16"
37'	251	3/4"	9/16"	5/8"	7/16"	3/4"	9/16"	5/8"	7/16"
38'	262	15/16"	11/16"	13/16"	9/16"	15/16"	11/16"	13/16"	9/16"
39'	262	1"	11/16"	13/16"	9/16"	1"	11/16"	13/16"	9/16"

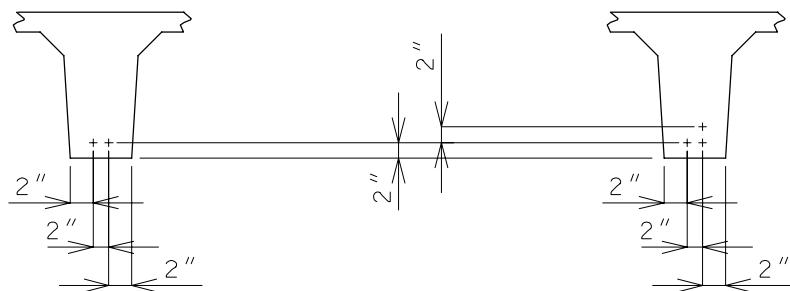
**24'-10" ROADWAY - BEAM TYPE 30 (4 GIRDER)**  
**SECTION PROPERTIES & STRAND ARRANGEMENT**

Superstructure



$A = 669.1$  sq. in.  
 $Y_b = 20.61$  in.  
 $I = 66,358$  in.<sup>4</sup>  
**EXTERIOR GIRDER**

$A = 680.0$  sq. in.  
 $Y_b = 20.79$  in.  
 $I = 67,575$  in.<sup>4</sup>  
**INTERIOR GIRDER**

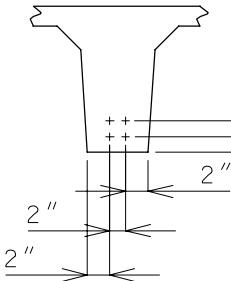


GIRDER SEQ. NO. 320  
(2 STRANDS - 0 DRAPED)

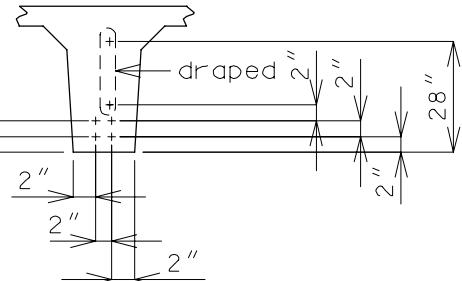
GIRDER SEQ. NO. 330  
(3 STRANDS - 0 DRAPED)

**24'-10" ROADWAY - BEAM TYPE 30**  
**SECTION PROPERTIES & STRAND ARRANGEMENT (CONT.)**

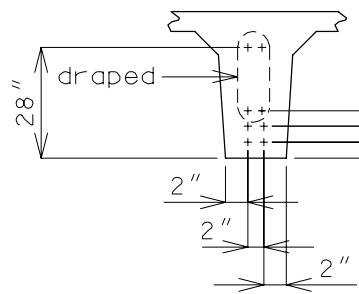
Superstructure



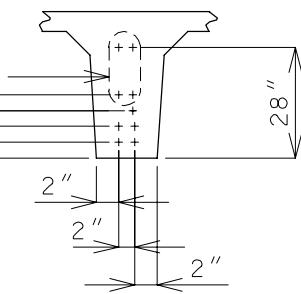
GIRDER SEQ. NO. 340  
 (4 STRANDS - 0 DRAPEd)



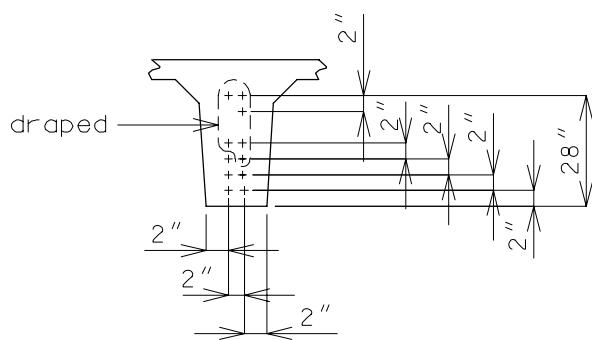
GIRDER SEQ. NO. 351  
 (5 STRANDS - 1 DRAPEd)



GIRDER SEQ. NO. 362  
 (6 STRANDS - 2 DRAPEd)



GIRDER SEQ. NO. 372  
 (7 STRANDS - 2 DRAPEd)



GIRDER SEQ. NO. 383  
 (8 STRANDS - 3 DRAPEd)

Note: Location of draped strands shown in top of stem  
 are at end of girder and draped strands in bott. of stem  
 are at £.

# Bridge Manual

**P/S Concrete Double-Tee Girders – Sec. 3.56**

**Page: 1.2-12**

**24'-10" ROADWAY – BEAM TYPE 30 (HS20 & HS20 MILITARY) Superstructure  
GIRDER REACTIONS**

Span & Bent Length	Girder No. Seq.	Dead Load Reaction, kips per stem		
		Interior Girder	Exterior Girder	
			Int. Stem	Ext. Stem
20'	320	6.98	7.51	8.76
21'	320	7.36	7.91	9.22
22'	320	7.73	8.31	9.69
23'	320	8.10	8.71	10.16
24'	320	8.47	9.11	10.62
25'	320	8.85	9.51	11.09
26'	320	9.22	9.91	11.56
27'	320	9.60	10.31	12.03
28'	320	9.96	10.71	12.49
29'	330	10.33	11.11	12.96
30'	330	10.71	11.51	13.43
31'	330	11.08	11.91	13.90
32'	330	11.46	12.31	14.36
33'	330	11.82	12.71	14.83
34'	330	12.20	13.11	15.30
35'	340	12.57	13.51	15.76
36'	340	12.95	13.92	16.23
37'	340	13.32	14.32	16.70
38'	340	13.69	14.72	17.17
39'	340	14.06	15.12	17.63
40'	340	14.43	15.52	18.10
41'	351	14.81	15.92	18.57
42'	351	15.18	16.32	19.04
43'	351	15.55	16.72	19.50
44'	351	15.92	17.12	19.97
45'	362	16.30	17.52	20.44
46'	362	16.67	17.92	20.90
47'	372	17.05	18.32	21.37
48'	372	17.41	18.71	21.82
49'	372	17.79	19.12	22.28
50'	383	18.16	19.52	22.76
51'	383	18.53	19.92	23.22
52'	383	18.90	20.32	23.69

# Bridge Manual

**P/S Concrete Double-Tee Girders - Sec. 3.56**

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**24'-10" ROADWAY - BEAM TYPE 30 (HS20 & HS20 MILITARY) Superstructure  
GIRDER CAMBER**

Span Length Seq.	Girder No. Seq.	Interior Girder				Exterior Girder			
		Girder Camber without Slab		Girder Camber with Slab		Girder Camber without Slab		Girder Camber with Slab	
		1/2 pt.	1/4 pt.	1/2 pt.	1/4 pt.	1/2 pt.	1/4 pt.	1/2 pt.	1/4 pt.
20'	320	1/16"	1/16"	1/16"	1/16"	1/16"	1/16"	1/16"	1/16"
21'	320	1/16"	1/16"	1/16"	1/16"	1/16"	1/16"	1/16"	1/16"
22'	320	1/8"	1/16"	1/16"	1/16"	1/8"	1/16"	1/16"	1/16"
23'	320	1/8"	1/16"	1/16"	1/16"	1/8"	1/16"	1/16"	1/16"
24'	320	1/8"	1/16"	1/8"	1/16"	1/8"	1/16"	1/8"	1/16"
25'	320	1/8"	1/16"	1/8"	1/16"	1/8"	1/16"	1/8"	1/16"
26'	320	1/8"	1/16"	1/8"	1/16"	1/8"	1/16"	1/8"	1/16"
27'	320	1/8"	1/16"	1/8"	1/16"	1/8"	1/16"	1/8"	1/16"
28'	320	1/8"	1/8"	1/8"	1/16"	1/8"	1/8"	1/8"	1/16"
29'	330	1/4"	3/16"	3/16"	1/8"	1/4"	3/16"	3/16"	1/8"
30'	330	1/4"	3/16"	3/16"	1/8"	1/4"	3/16"	3/16"	1/8"
31'	330	1/4"	3/16"	1/4"	3/16"	1/4"	3/16"	1/4"	3/16"
32'	330	1/4"	3/16"	1/4"	3/16"	1/4"	3/16"	1/4"	3/16"
33'	330	1/4"	3/16"	1/4"	3/16"	1/4"	3/16"	1/4"	3/16"
34'	330	5/16"	3/16"	1/4"	3/16"	5/16"	3/16"	1/4"	3/16"
35'	340	7/16"	5/16"	3/8"	1/4"	7/16"	5/16"	3/8"	1/4"
36'	340	7/16"	5/16"	3/8"	1/4"	7/16"	5/16"	3/8"	1/4"
37'	340	1/2"	5/16"	3/8"	5/16"	1/2"	5/16"	3/8"	5/16"
38'	340	1/2"	3/8"	7/16"	5/16"	1/2"	3/8"	7/16"	5/16"
39'	340	1/2"	3/8"	7/16"	5/16"	1/2"	3/8"	7/16"	5/16"
40'	340	1/2"	3/8"	7/16"	5/16"	1/2"	3/8"	7/16"	5/16"
41'	351	5/8"	7/16"	9/16"	3/8"	5/8"	7/16"	9/16"	3/8"
42'	351	11/16"	1/2"	9/16"	3/8"	11/16"	1/2"	9/16"	3/8"
43'	351	11/16"	1/2"	9/16"	3/8"	11/16"	1/2"	9/16"	3/8"
44'	351	11/16"	1/2"	9/16"	3/8"	11/16"	1/2"	9/16"	3/8"
45'	362	7/8"	5/8"	11/16"	1/2"	7/8"	5/8"	11/16"	1/2"
46'	362	7/8"	5/8"	11/16"	1/2"	7/8"	5/8"	11/16"	1/2"
47'	372	1"	11/16"	13/16"	11/16"	1"	11/16"	13/16"	11/16"
48'	372	1"	3/4"	13/16"	5/8"	1"	3/4"	13/16"	5/8"
49'	372	1-1/16"	3/4"	13/16"	5/8"	1-1/16"	3/4"	13/16"	5/8"
50'	383	1-1/4"	7/8"	1"	3/4"	1-1/4"	7/8"	1"	3/4"
51'	383	1-1/4"	7/8"	1"	3/4"	1-1/4"	7/8"	1"	3/4"
52'	383	1-5/16"	15/16"	1"	3/4"	1-5/16"	15/16"	1"	3/4"

# Bridge Manual

**P/S Concrete Double-Tee Girders – Sec. 3.56**

**Page: 1.3-1**

**26'-10" ROADWAY**

**GIRDER SPAN LENGTH (HS20 & HS20 MILITARY LOADING)**

**Superstructure**

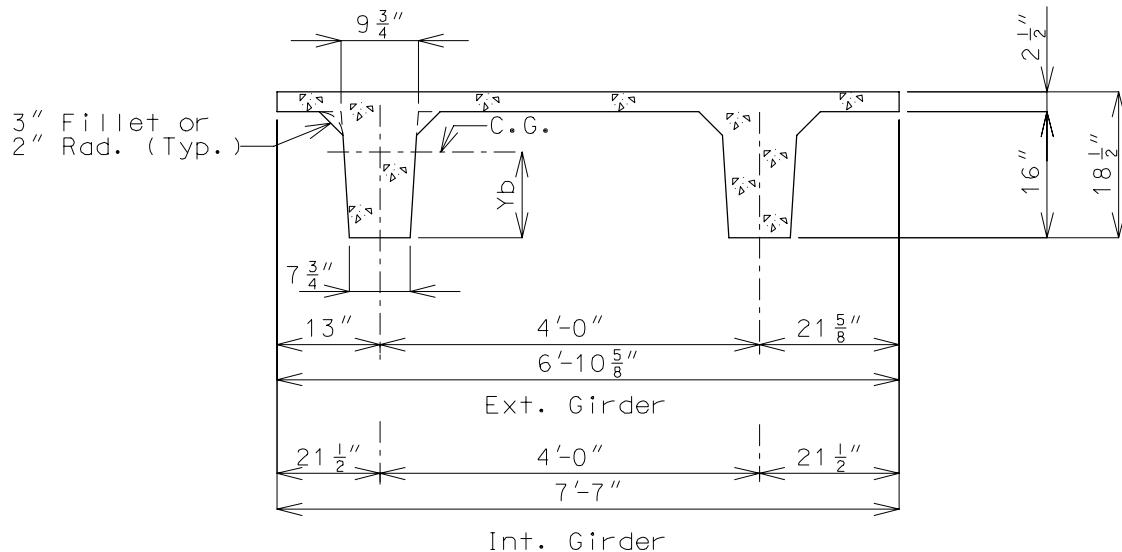
Span Length	Allowable Span Length For P/S Concrete Double-Tee Girder Spans					
	Type 30		Type 22		Type 16	
Span Length	Girder Seq. No.	Span Length	Girder Seq. No.	Span Length	Girder Seq. No.	
20'		20' thru 24'	320	20' & 21'	220	
21'				22' thru 27'	230	
22'				28' thru 32'	240	
23'				33' thru 35'	251	
24'				36' & 37'	262	
25'						
26'						
27'						
28'						
29'						
30'						
31'						
32'						
33'						
34'						
35'						
36'						
37'						
38'						
39'						
40'						
41'						
42'						
43'						
44'						
45'						
46'						
47'						
48'						
49'						
50'						

**Note:**

The maximum span lengths shown for P/S Double-Tee Girders are based on a minimum of 2-spans (continuous) being used. If one of these P/S Double-Tee Girders is used as one simple span, then the span lengths should be reduced from the maximum allowable span shown, and the girder design should be checked.

26'-10" ROADWAY - BEAM TYPE 16 (4 GIRDER)  
SECTION PROPERTIES & STRAND ARRANGEMENT

Superstructure

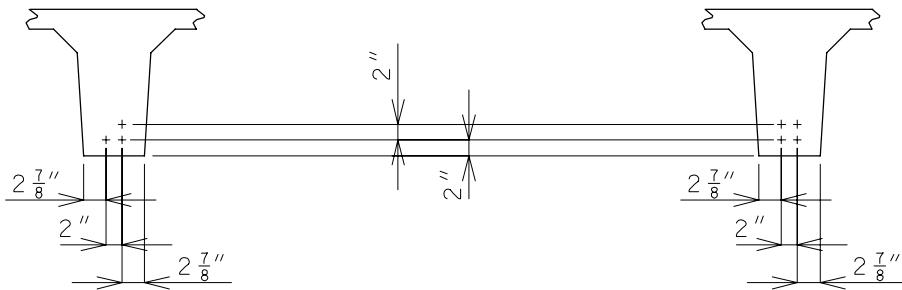


$A = 486.6$  sq. in.  
 $Y_b = 12.10$  in.  
 $I = 15,567$  in.<sup>4</sup>  
 EXTERIOR GIRDER

$A = 507.5$  sq. in.  
 $Y_b = 12.31$  in.  
 $I = 16,109$  in.<sup>4</sup>  
 INTERIOR GIRDER

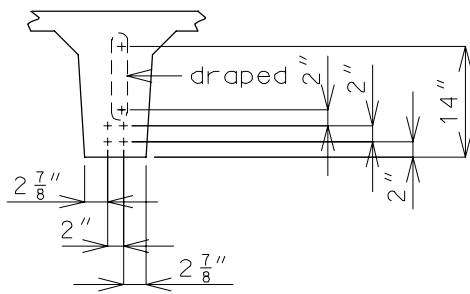
26'-10" ROADWAY - BEAM TYPE 16 (4 GIRDER)  
SECTION PROPERTIES & STRAND ARRANGEMENT (CONT.)

Superstructure



GIRDER SEQ. NO. 130  
(3 STRANDS - 0 DRAPED)

GIRDER SEQ. NO. 140  
(4 STRANDS - 0 DRAPED)



GIRDER SEQ. NO. 151  
(5 STRANDS - 1 DRAPED)

Note: Location of draped strands shown in top of stem are at end of girder and draped strands in bott. of stem are at C.

## Bridge Manual

P/S Concrete Double-Tee Girders – Sec. 3.56

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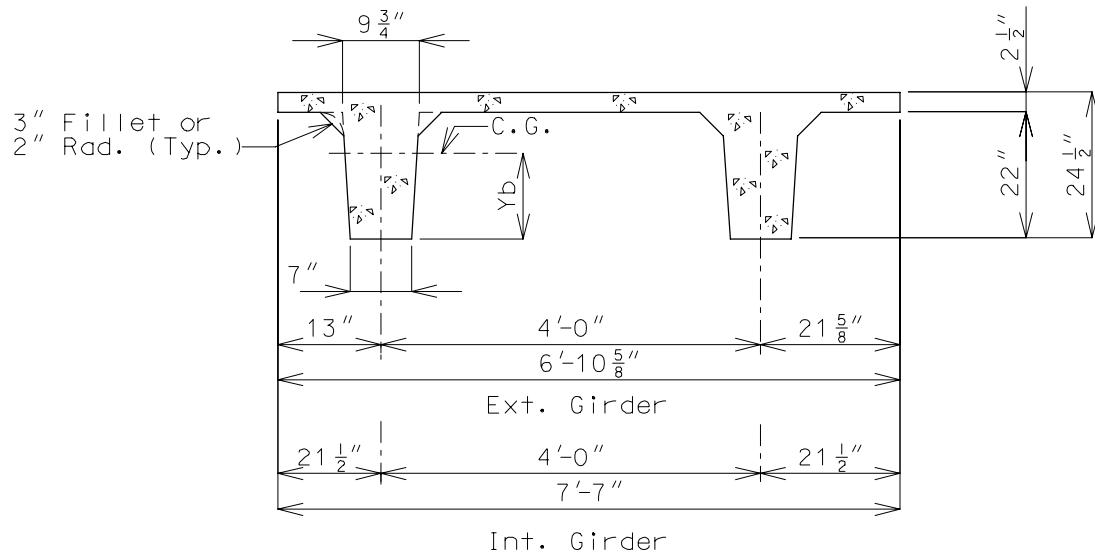
**26'-10" ROADWAY - BEAM TYPE 16 (HS20 & HS20 MILITARY) Superstructure  
GIRDER REACTIONS**

Reactions are DL1 + DL2 from BR202 (Simple Span).



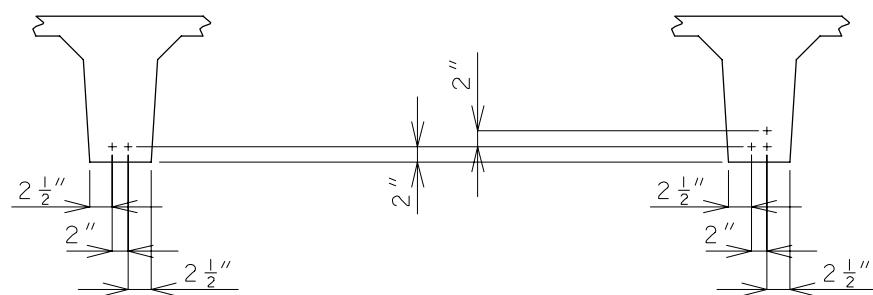
**26'-10" ROADWAY - BEAM TYPE 22 (4 GIRDER)**  
**SECTION PROPERTIES & STRAND ARRANGEMENT**

Superstructure



$A = 575.1$  sq. in.  
 $Y_b = 15.79$  in.  
 $I = 32,796$  in.<sup>4</sup>  
**EXTERIOR GIRDER**

$A = 576.0$  sq. in.  
 $Y_b = 16.05$  in.  
 $I = 33,932$  in.<sup>4</sup>  
**INTERIOR GIRDER**

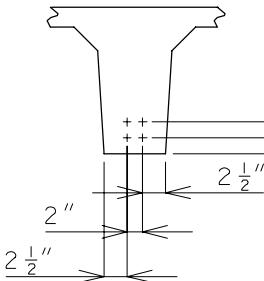


GIRDER SEQ. NO. 220  
(2 STRANDS - 0 DRAPED)

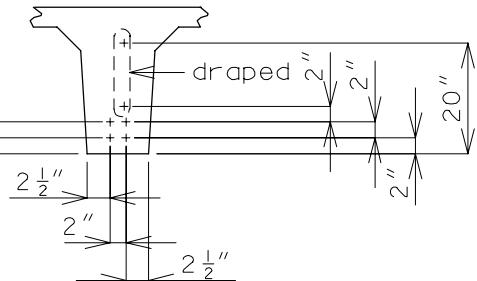
GIRDER SEQ. NO. 230  
(3 STRANDS - 0 DRAPED)

**26'-10" ROADWAY - BEAM TYPE 22**  
**SECTION PROPERTIES & STRAND ARRANGEMENT (CONT.)**

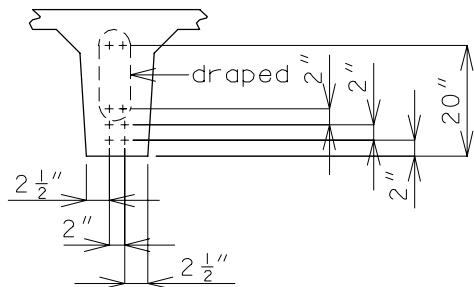
Superstructure



GIRDER SEQ. NO. 240  
 (4 STRANDS - 0 DRAPED)



GIRDER SEQ. NO. 251  
 (5 STRANDS - 1 DRAPED)



GIRDER SEQ. NO. 262  
 (6 STRANDS - 2 DRAPED)

Note: Location of draped strands shown in top of stem  
 are at end of girder and draped strands in bott. of stem  
 are at ℥.

# Bridge Manual

**P/S Concrete Double-Tee Girders – Sec. 3.56**

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**26'-10" ROADWAY – BEAM TYPE 22 (HS20 & HS20 MILITARY) Superstructure  
GIRDER REACTIONS**

Length & Bent Span Seq.	Girder No. Seq.	Dead Load Reaction, kips per stem		
		Interior Girder	Exterior Girder	
			Int. Stem	Ext. Stem
20'	220	6.82	7.29	8.28
21'	220	7.17	7.68	8.72
22'	230	7.54	8.06	9.16
23'	230	7.90	8.45	9.60
24'	230	8.27	8.84	10.04
25'	230	8.64	9.23	10.48
26'	230	8.99	9.62	10.92
27'	230	9.36	10.01	11.37
28'	240	9.72	10.40	11.81
29'	240	10.09	10.79	12.25
30'	240	10.45	11.17	12.69
31'	240	10.81	11.56	13.13
32'	240	11.18	11.95	13.57
33'	251	11.54	12.34	14.02
34'	251	11.91	12.73	14.46
35'	251	12.26	13.10	14.89
36'	262	12.61	13.49	15.31
37'	262	12.98	13.88	15.76

Reactions are DL1 + DL2 from BR202 (Simple Span).

# Bridge Manual

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P/S Concrete Double-Tee Girders - Sec. 3.56

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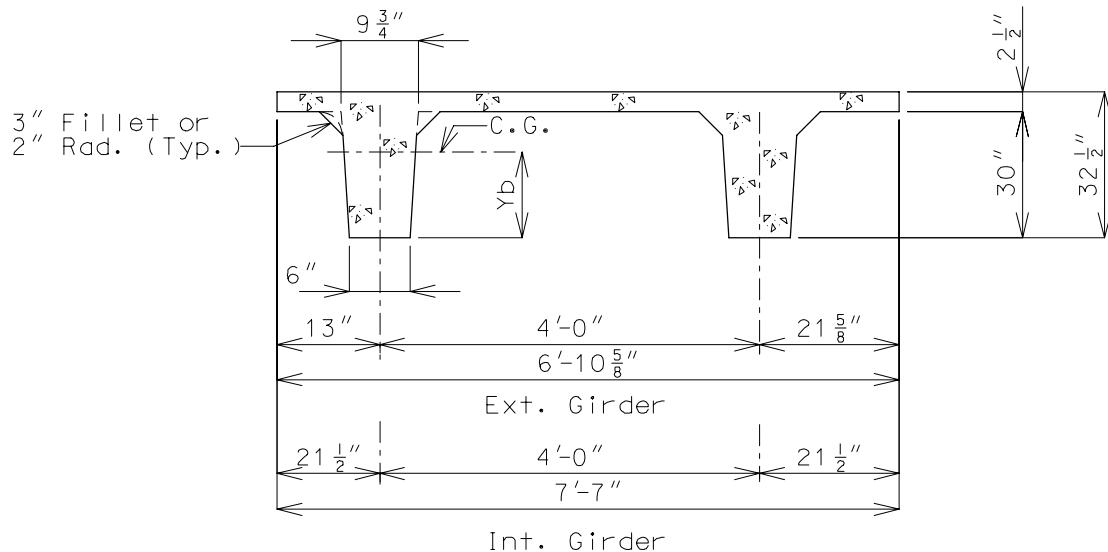
26'-10" ROADWAY - BEAM TYPE 22 (HS20 & HS20 MILITARY) Superstructure  
GIRDER CAMBER

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Length Bent Span Seq	Girder No. Seq.	Interior Girder				Exterior Girder			
		Girder Camber without Slab		Girder Camber with Slab		Girder Camber without Slab		Girder Camber with Slab	
		1/2 pt.	1/4 pt.	1/2 pt.	1/4 pt.	1/2 pt.	1/4 pt.	1/2 pt.	1/4 pt.
20'	220	1/8"	1/16"	1/8"	1/16"	1/8"	1/16"	1/8"	1/16"
21'	220	1/8"	1/16"	1/8"	1/16"	1/8"	1/16"	1/8"	1/16"
22'	230	3/16"	1/8"	3/16"	1/8"	3/16"	1/8"	3/16"	1/8"
23'	230	1/4"	3/16"	3/16"	1/8"	1/4"	3/16"	3/16"	1/8"
24'	230	1/4"	3/16"	3/16"	1/8"	1/4"	3/16"	3/16"	1/8"
25'	230	1/4"	3/16"	1/4"	3/16"	1/4"	3/16"	1/4"	3/16"
26'	230	1/4"	3/16"	1/4"	3/16"	1/4"	3/16"	1/4"	3/16"
27'	230	5/16"	3/16"	1/4"	3/16"	5/16"	3/16"	1/4"	3/16"
28'	240	7/16"	5/16"	3/8"	1/4"	7/16"	5/16"	3/8"	1/4"
29'	240	7/16"	5/16"	3/8"	1/4"	7/16"	5/16"	3/8"	5/16"
30'	240	7/16"	5/16"	3/8"	5/16"	7/16"	5/16"	3/8"	5/16"
31'	240	1/2"	3/8"	7/16"	5/16"	1/2"	3/8"	7/16"	5/16"
32'	240	1/2"	3/8"	7/16"	5/16"	1/2"	3/8"	7/16"	5/16"
33'	251	11/16"	1/2"	9/16"	3/8"	11/16"	1/2"	9/16"	3/8"
34'	251	11/16"	1/2"	9/16"	7/16"	11/16"	1/2"	9/16"	7/16"
35'	251	11/16"	1/2"	5/8"	7/16"	11/16"	1/2"	5/8"	7/16"
36'	262	7/8"	5/8"	3/4"	1/2"	7/8"	5/8"	3/4"	1/2"
37'	262	7/8"	5/8"	3/4"	9/16"	7/8"	5/8"	3/4"	9/16"

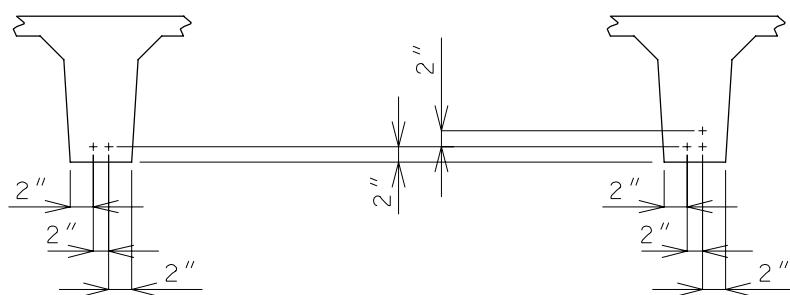
**26'-10" ROADWAY - BEAM TYPE 30 (4 GIRDER)**  
**SECTION PROPERTIES & STRAND ARRANGEMENT**

Superstructure



$A = 679.1$  sq. in.  
 $Y_b = 20.77$  in.  
 $I = 67,472$  in.<sup>4</sup>  
 EXTERIOR GIRDER

$A = 700.0$  sq. in.  
 $Y_b = 21.08$  in.  
 $I = 69,713$  in.<sup>4</sup>  
 INTERIOR GIRDER

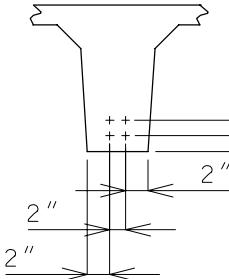


GIRDER SEQ. NO. 320  
 (2 STRANDS - 0 DRAPED)

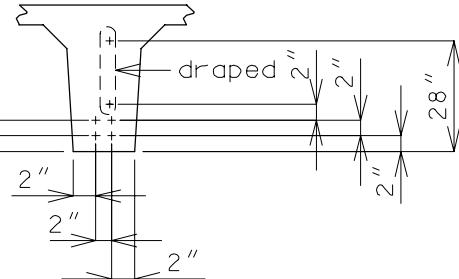
GIRDER SEQ. NO. 330  
 (3 STRANDS - 0 DRAPED)

**26'-10" ROADWAY - BEAM TYPE 30**  
**SECTION PROPERTIES & STRAND ARRANGEMENT (CONT.)**

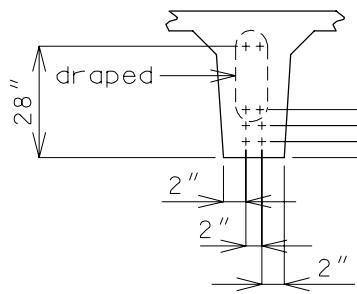
Superstructure



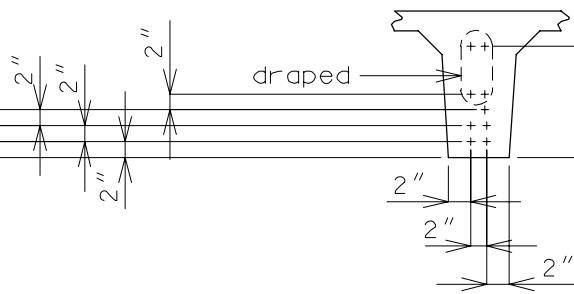
GIRDER SEQ. NO. 340  
 (4 STRANDS - 0 DRAPEd)



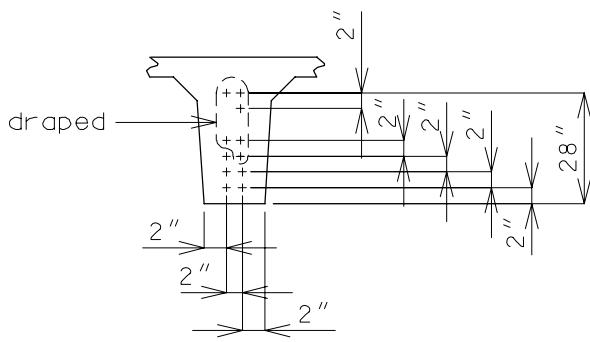
GIRDER SEQ. NO. 351  
 (5 STRANDS - 1 DRAPEd)



GIRDER SEQ. NO. 362  
 (6 STRANDS - 2 DRAPEd)



GIRDER SEQ. NO. 372  
 (7 STRANDS - 2 DRAPEd)



GIRDER SEQ. NO. 383  
 (8 STRANDS - 3 DRAPEd)

Note: Location of draped strands shown in top of stem  
 are at end of girder and draped strands in bott. of stem  
 are at ℒ.

# Bridge Manual

**P/S Concrete Double-Tee Girders – Sec. 3.56**

**Page: 1.3-12**

**26'-10" ROADWAY – BEAM TYPE 30 (HS20 & HS20 MILITARY) Superstructure  
GIRDER REACTIONS**

Length Span Seq'	Girder No. Seq.	Dead Load Reaction, kips per stem		
		Interior Girder	Exterior Girder	
			Int. Stem	Ext. Stem
20'	320	7.32	7.79	8.79
21'	320	7.71	8.21	9.25
22'	320	8.10	8.63	9.72
23'	320	8.49	9.04	10.19
24'	320	8.89	9.46	10.66
25'	330	9.28	9.87	11.13
26'	330	9.66	10.29	11.60
27'	330	10.05	10.71	12.06
28'	330	10.45	11.12	12.53
29'	330	10.84	11.54	13.00
30'	330	11.23	11.95	13.47
31'	330	11.62	12.37	13.94
32'	330	12.01	12.79	14.41
33'	340	12.40	13.20	14.88
34'	340	12.79	13.62	15.34
35'	340	13.19	14.03	15.81
36'	340	13.57	14.45	16.28
37'	340	13.96	14.87	16.75
38'	340	14.36	15.28	17.22
39'	351	14.74	15.70	17.69
40'	351	15.14	16.11	18.16
41'	351	15.52	16.53	18.63
42'	351	15.92	16.94	19.09
43'	362	16.31	17.36	19.56
44'	362	16.70	17.78	20.02
45'	362	17.09	18.19	20.50
46'	372	17.47	18.59	20.95
47'	372	17.86	19.00	21.42
48'	383	18.26	19.43	21.88
49'	383	18.64	19.84	22.35
50'	383	19.04	20.26	22.82

Reactions are DL1 + DL2 from BR202 (Simple Span).

# Bridge Manual

**P/S Concrete Double-Tee Girders - Sec. 3.56**

**Page: 1.3-13**

**26'-10" ROADWAY - BEAM TYPE 30 (HS20 & HS20 MILITARY) Superstructure  
GIRDER CAMBER**

Span Length Bent Q+o	Girder No. Seq.	Interior Girder				Exterior Girder			
		Girder Camber without Slab		Girder Camber with Slab		Girder Camber without Slab		Girder Camber with Slab	
		1/2 pt.	1/4 pt.	1/2 pt.	1/4 pt.	1/2 pt.	1/4 pt.	1/2 pt.	1/4 pt.
20'	320	1/16"	1/16"	1/16"	1/16"	1/16"	1/16"	1/16"	1/16"
21'	320	1/16"	1/16"	1/16"	1/16"	1/16"	1/16"	1/16"	1/16"
22'	320	1/16"	1/16"	1/16"	1/16"	1/8"	1/16"	1/16"	1/16"
23'	320	1/8"	1/16"	1/16"	1/16"	1/8"	1/16"	1/16"	1/16"
24'	320	1/8"	1/16"	1/16"	1/16"	1/8"	1/16"	1/8"	1/16"
25'	330	3/16"	1/8"	3/16"	1/8"	3/16"	1/8"	3/16"	1/8"
26'	330	3/16"	1/8"	3/16"	1/8"	3/16"	1/8"	3/16"	1/8"
27'	330	3/16"	1/8"	3/16"	1/8"	3/16"	1/8"	3/16"	1/8"
28'	330	3/16"	1/8"	3/16"	1/8"	3/16"	1/8"	3/16"	1/8"
29'	330	1/4"	3/16"	3/16"	1/8"	1/4"	3/16"	3/16"	1/8"
30'	330	1/4"	3/16"	3/16"	1/8"	1/4"	3/16"	3/16"	1/8"
31'	330	1/4"	3/16"	3/16"	1/8"	1/4"	3/16"	3/16"	1/8"
32'	330	1/4"	3/16"	3/16"	1/8"	1/4"	3/16"	3/16"	1/8"
33'	340	3/8"	1/4"	5/16"	1/4"	3/8"	1/4"	5/16"	1/4"
34'	340	3/8"	1/4"	5/16"	1/4"	3/8"	1/4"	5/16"	1/4"
35'	340	7/16"	5/16"	3/8"	1/4"	7/16"	5/16"	3/8"	1/4"
36'	340	7/16"	5/16"	3/8"	1/4"	7/16"	5/16"	3/8"	1/4"
37'	340	7/16"	5/16"	3/8"	1/4"	7/16"	5/16"	3/8"	1/4"
38'	340	7/16"	5/16"	3/8"	1/4"	7/16"	5/16"	3/8"	1/4"
39'	351	5/8"	7/16"	1/2"	3/8"	5/8"	7/16"	1/2"	3/8"
40'	351	5/8"	7/16"	1/2"	3/8"	5/8"	7/16"	1/2"	3/8"
41'	351	5/8"	7/16"	1/2"	3/8"	5/8"	7/16"	1/2"	3/8"
42'	351	5/8"	7/16"	9/16"	3/8"	5/8"	7/16"	9/16"	3/8"
43'	362	3/4"	1/2"	5/8"	7/16"	3/4"	1/2"	5/8"	7/16"
44'	362	3/4"	9/16"	5/8"	7/16"	3/4"	9/16"	5/8"	7/16"
45'	362	3/4"	9/16"	5/8"	7/16"	3/4"	9/16"	5/8"	7/16"
46'	372	1"	11/16"	13/16"	9/16"	1"	11/16"	13/16"	9/16"
47'	372	1"	11/16"	13/16"	9/16"	1"	11/16"	13/16"	9/16"
48'	383	1-3/16"	13/16"	1"	11/16"	1-3/16"	13/16"	1"	11/16"
49'	383	1-3/16"	7/8"	1"	11/16"	1-3/16"	7/8"	1"	11/16"
50'	383	1-1/4"	7/8"	1"	11/16"	1-1/4"	7/8"	1"	11/16"

# Bridge Manual

**P/S Concrete Double-Tee Girders – Sec. 3.56**

**Page: 1.4-1**

**32'-10" ROADWAY  
GIRDER SPAN LENGTH (HS20 & HS20 MILITARY LOADING)**

**Superstructure**

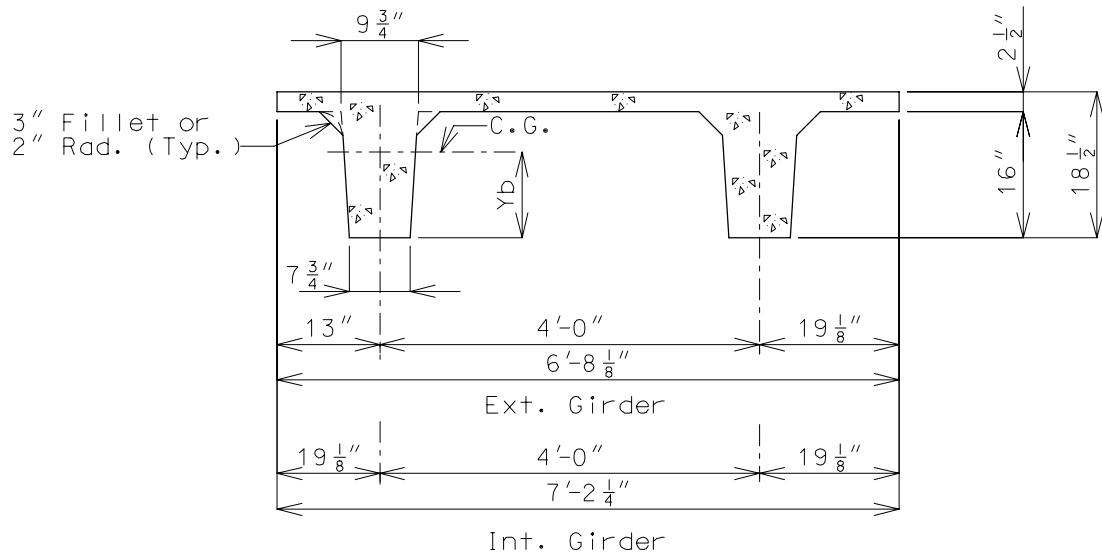
Span Length	Allowable Span Length For P/S Concrete Double-Tee Girder Spans					
	Type 30		Type 22		Type 16	
Span Length	Girder Seq. No.	Span Length	Girder Seq. No.	Span Length	Girder Seq. No.	
20'			20' & 21'	220		
21'						
22'			22' thru 28'	230		
23'						
24'						
25'						
26'						
27'						
28'						
29'			29' thru 33'	240		
30'						
31'						
32'			34' thru 36'	251		
33'						
34'			37' & 38'	262		
35'						
36'						
37'						
38'						
39'						
40'						
41'						
42'						
43'						
44'						
45'						
46'						
47'						
48'						
49'						
50'						
51'						

**Note:**

The maximum span lengths shown for P/S Double-Tee Girders are based on a minimum of 2-spans (continuous) being used. If one of these P/S Double-Tee Girders is used as one simple span, then the span lengths should be reduced from the maximum allowable span shown, and the girder design should be checked.

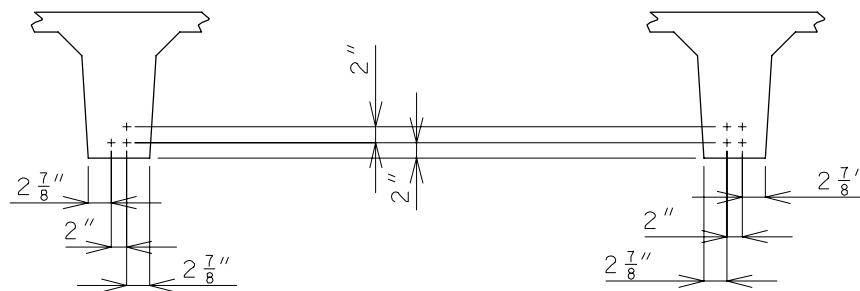
**32'-10" ROADWAY - BEAM TYPE 16 (5 GIRDER)**  
**SECTION PROPERTIES & STRAND ARRANGEMENT**

Superstructure



$A = 480.3$  sq. in.  
 $y_b = 12.04$  in.  
 $I = 15,396$  in.<sup>4</sup>  
**EXTERIOR GIRDER**

$A = 495.6$  sq. in.  
 $y_b = 12.20$  in.  
 $I = 15,807$  in.<sup>4</sup>  
**INTERIOR GIRDER**

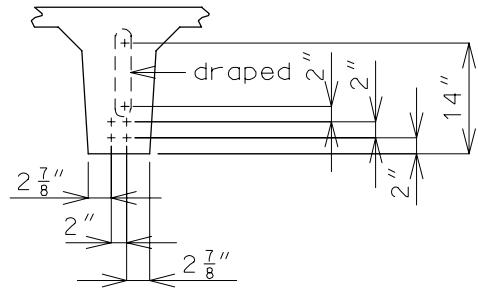


GIRDER SEQ. NO. 130  
(3 STRANDS - 0 DRAPED)

GIRDER SEQ. NO. 140  
(4 STRANDS - 0 DRAPED)

32'-10" ROADWAY - BEAM TYPE 16 (5 GIRDER)  
SECTION PROPERTIES & STRAND ARRANGEMENT (CONT.)

Superstructure



GIRDER SEQ. NO. 151  
(5 STRANDS - 1 DRAPED)

Note: Location of draped strands shown in top of stem  
are at end of girder and draped strands in bott. of stem  
are at Q.

## Bridge Manual

**P/S Concrete Double-Tee Girders - Sec. 3.56**

**Page: 1.4-4**

**32'-10" ROADWAY - BEAM TYPE 16 (HS20 & HS20 MILITARY) Superstructure  
GIRDER REACTIONS**

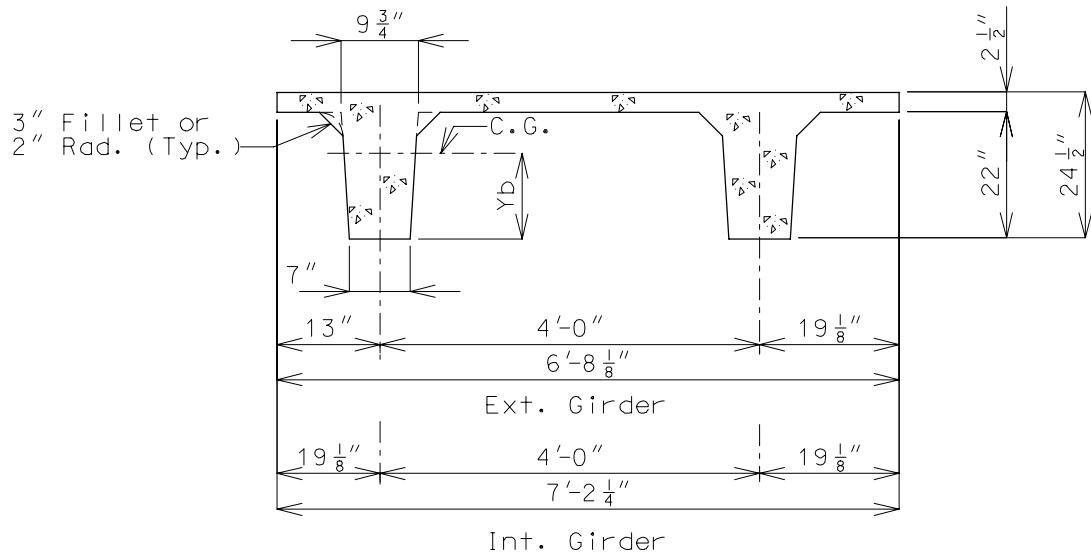
Length Span of Bent	Girder Seq. No.	Dead Load Reaction, kips per stem		
		Interior Girder	Exterior Girder	
			Int. Stem	Ext. Stem
20'	130	6.25	6.75	7.65
21'	130	6.57	7.11	8.05
22'	130	6.91	7.47	8.46
23'	130	7.24	7.82	8.86
24'	140	7.57	8.18	9.27
25'	140	7.90	8.54	9.67
26'	140	8.23	8.89	10.08
27'	140	8.56	9.25	10.48
28'	140	8.84	9.61	10.89
29'	151	9.22	9.97	11.29

Reactions are DL1 + DL2 from BR202 (Simple Span).



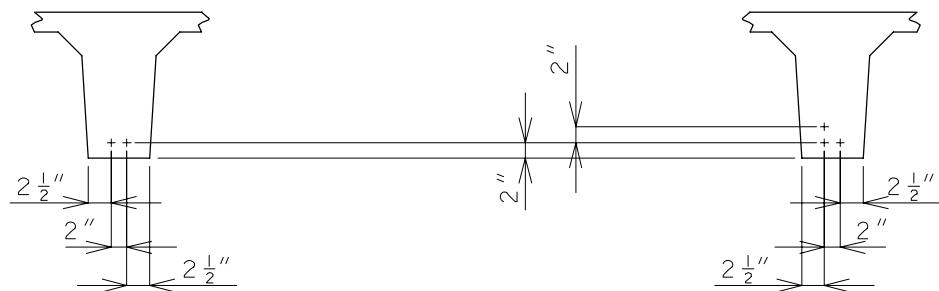
**32'-10" ROADWAY - BEAM TYPE 22 (5 GIRDER)**  
**SECTION PROPERTIES & STRAND ARRANGEMENT**

Superstructure



$A = 568.8$  sq. in.  
 $y_b = 15.70$  in.  
 $I = 32,440$  in.<sup>4</sup>  
**EXTERIOR GIRDER**

$A = 584.1$  sq. in.  
 $y_b = 15.90$  in.  
 $I = 33,297$  in.<sup>4</sup>  
**INTERIOR GIRDER**

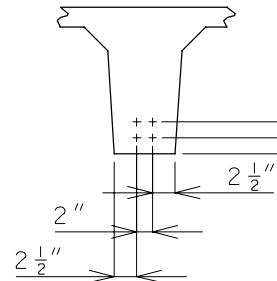


GIRDER SEQ. NO. 220  
(2 STRANDS - 0 DRAPED)

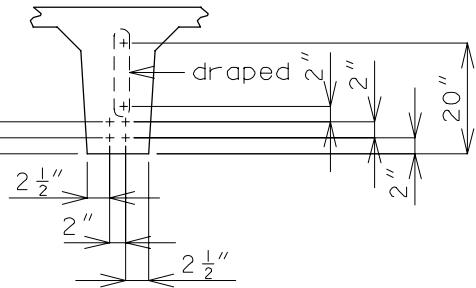
GIRDER SEQ. NO. 230  
(3 STRANDS - 0 DRAPED)

**32'-10" ROADWAY - BEAM TYPE 22**  
**SECTION PROPERTIES & STRAND ARRANGEMENT (CONT.)**

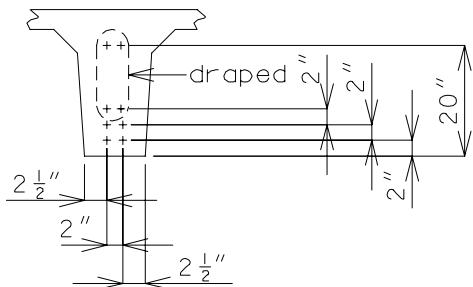
Superstructure



GIRDER SEQ. NO. 240  
 (4 STRANDS - 0 DRAPED)



GIRDER SEQ. NO. 251  
 (5 STRANDS - 1 DRAPED)



GIRDER SEQ. NO. 262  
 (6 STRANDS - 2 DRAPED)

Note: Location of draped strands shown in top of stem are at end of girder and draped strands in bott. of stem are at Q.

# Bridge Manual

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P/S Concrete Double-Tee Girders - Sec. 3.56

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32'-10" ROADWAY - BEAM TYPE 22 (HS20 & HS20 MILITARY) Superstructure  
GIRDER REACTIONS

Span Length Bent	Girder No. Seq.	Dead Load Reaction, kips per stem		
		Interior Girder	Exterior Girder	
			Int. Stem	Ext. Stem
20'	220	6.67	7.17	8.01
21'	220	7.02	7.55	8.44
22'	230	7.38	7.93	8.87
23'	230	7.74	8.31	9.30
24'	230	8.09	8.70	9.72
25'	230	8.45	9.08	10.15
26'	230	8.80	9.46	10.58
27'	230	9.16	9.84	11.00
28'	230	9.51	10.22	11.43
29'	240	9.86	10.61	11.86
30'	240	10.22	10.99	12.28
31'	240	10.57	11.37	12.71
32'	240	10.93	11.75	13.14
33'	240	11.29	12.13	13.56
34'	251	11.64	12.51	13.99
35'	251	12.00	12.90	14.42
36'	251	12.35	13.28	14.84
37'	262	12.69	13.66	15.26
38'	262	13.05	14.04	15.68

Reactions are DL1 + DL2 from BR202 (Simple Span).

# Bridge Manual

## P/S Concrete Double-Tee Girders - Sec. 3.56

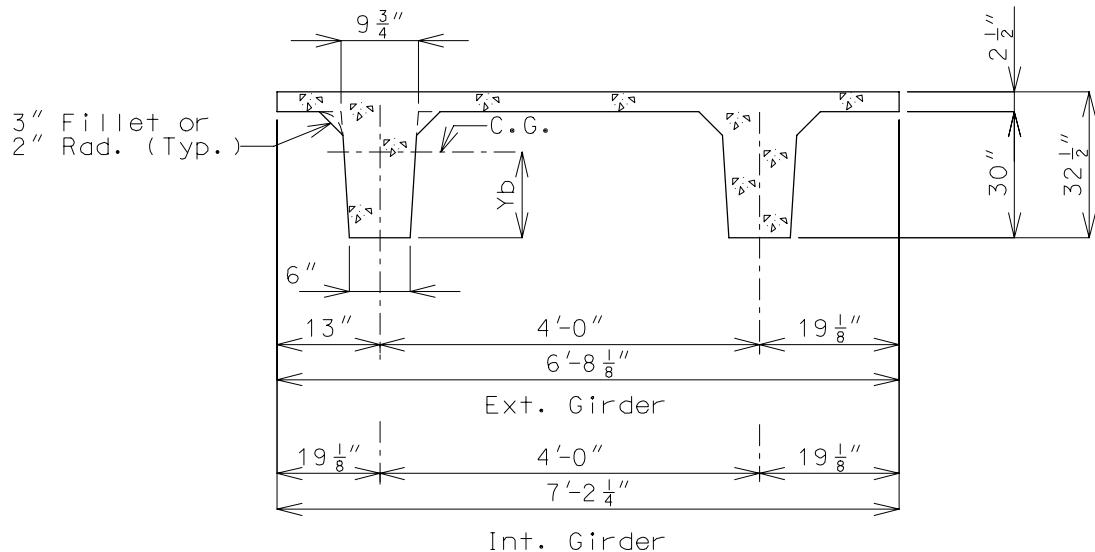
Page: 1.4-9

**32'-10" ROADWAY - BEAM TYPE 22 (HS20 & HS20 MILITARY) Superstructure**  
**GIRDER CAMBER**

Length Span over Bent	Girder No. Seq.	Interior Girder				Exterior Girder			
		Girder Camber without Slab		Girder Camber with Slab		Girder Camber without Slab		Girder Camber with Slab	
		1/2 pt.	1/4 pt.	1/2 pt.	1/4 pt.	1/2 pt.	1/4 pt.	1/2 pt.	1/4 pt.
20'	220	1/8"	1/16"	1/8"	1/16"	1/8"	1/16"	1/8"	1/16"
21'	220	1/8"	1/16"	1/8"	1/16"	1/8"	1/16"	1/8"	1/16"
22'	230	3/16"	1/8"	3/16"	1/8"	3/16"	1/8"	3/16"	1/8"
23'	230	1/4"	3/16"	3/16"	1/8"	1/4"	3/16"	3/16"	1/4"
24'	230	1/4"	3/16"	1/4"	3/16"	1/4"	3/16"	1/4"	3/16"
25'	230	1/4"	3/16"	1/4"	3/16"	1/4"	3/16"	1/4"	3/16"
26'	230	1/4"	3/16"	1/4"	3/16"	1/4"	3/16"	1/4"	3/16"
27'	230	5/16"	3/16"	1/4"	3/16"	5/16"	3/16"	1/4"	3/16"
28'	230	5/16"	3/16"	1/4"	3/16"	5/16"	3/16"	1/4"	3/16"
29'	240	7/16"	5/16"	3/8"	5/16"	7/16"	5/16"	3/8"	5/16"
30'	240	1/2"	5/16"	7/16"	5/16"	1/2"	5/16"	7/16"	5/16"
31'	240	1/2"	3/8"	7/16"	5/16"	1/2"	3/8"	7/16"	5/16"
32'	240	1/2"	3/8"	7/16"	5/16"	1/2"	3/8"	7/16"	5/16"
33'	240	9/16"	3/8"	7/16"	5/16"	9/16"	3/8"	7/16"	5/16"
34'	251	11/16"	1/2"	5/8"	7/16"	11/16"	1/2"	5/8"	7/16"
35'	251	11/16"	1/2"	5/8"	7/16"	11/16"	1/2"	5/8"	7/16"
36'	251	3/4"	1/2"	5/8"	7/16"	3/4"	1/2"	5/8"	7/16"
37'	262	7/8"	5/8"	3/4"	9/16"	7/8"	5/8"	3/4"	9/16"
38'	262	15/16"	11/16"	13/16"	9/16"	15/16"	11/16"	13/16"	9/16"

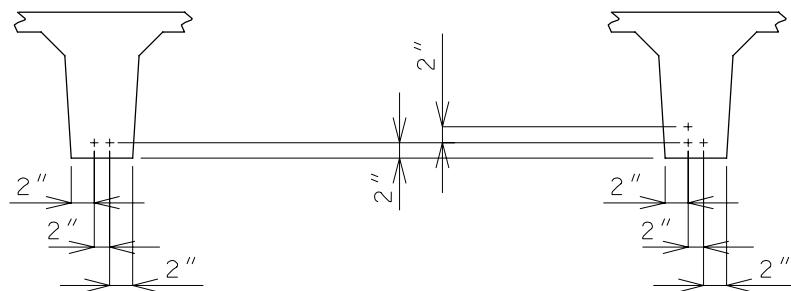
**32'-10" ROADWAY - BEAM TYPE 30 (5 GIRDER)**  
**SECTION PROPERTIES & STRAND ARRANGEMENT**

Superstructure



A = 672.8 sq. in.  
Y<sub>b</sub> = 20.67 in.  
I = 66,776 in.<sup>4</sup>  
**EXTERIOR GIRDER**

A = 688.1 sq. in.  
Y<sub>b</sub> = 20.91 in.  
I = 68,458 in.<sup>4</sup>  
**INTERIOR GIRDER**

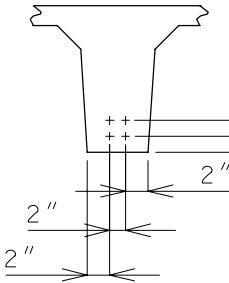


GIRDER SEQ. NO. 320  
(2 STRANDS - 0 DRAPED)

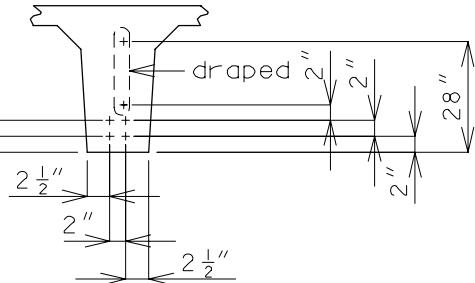
GIRDER SEQ. NO. 330  
(3 STRANDS - 0 DRAPED)

**32'-10" ROADWAY - BEAM TYPE 30**  
**SECTION PROPERTIES & STRAND ARRANGEMENT (CONT.)**

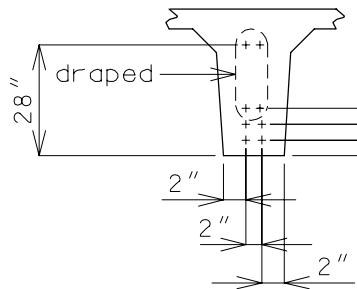
Superstructure



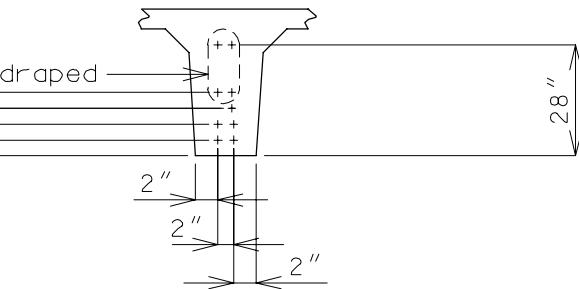
GIRDER SEQ. NO. 340  
 (4 STRANDS - 0 DRAPED)



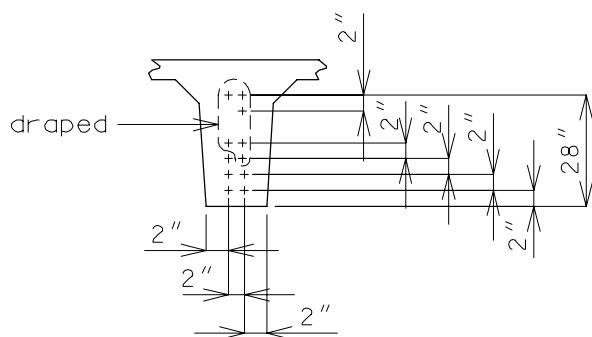
GIRDER SEQ. NO. 351  
 (5 STRANDS - 1 DRAPED)



GIRDER SEQ. NO. 362  
 (6 STRANDS - 2 DRAPED)



GIRDER SEQ. NO. 372  
 (7 STRANDS - 2 DRAPED)



GIRDER SEQ. NO. 383  
 (8 STRANDS - 3 DRAPED)

Note: Location of draped strands shown in top of stem are at end of girder and draped strands in bott. of stem are at €.

# Bridge Manual

**P/S Concrete Double-Tee Girders – Sec. 3.56**

**Page: 1.4-12**

**32'-10" ROADWAY – BEAM TYPE 30 (HS20 & HS20 MILITARY) Superstructure  
GIRDER REACTIONS**

Length + Span Seq	Girder No.	Dead Load Reaction, kips per stem		
		Interior Girder	Exterior Girder	
			Int. Stem	Ext. Stem
20'	320	7.09	7.58	8.41
21'	320	7.47	7.99	8.87
22'	320	7.86	8.40	9.32
23'	320	8.24	8.81	9.78
24'	320	8.62	9.22	10.23
25'	320	9.00	9.62	10.68
26'	320	9.38	10.03	11.14
27'	330	9.77	10.44	11.59
28'	330	10.15	10.85	12.05
29'	330	10.53	11.26	12.50
30'	330	10.92	11.67	12.95
31'	330	11.29	12.08	13.41
32'	330	11.68	12.49	13.86
33'	330	12.07	12.90	14.31
34'	340	12.44	13.30	14.77
35'	340	12.83	13.71	15.22
36'	340	13.20	14.12	15.68
37'	340	13.59	14.53	16.13
38'	340	13.98	14.94	16.58
39'	340	14.35	15.35	17.04
40'	351	14.74	15.76	17.49
41'	351	15.12	16.17	17.95
42'	351	15.50	16.58	18.40
43'	351	15.89	16.99	18.85
44'	362	16.27	17.39	19.31
45'	362	16.65	17.80	19.76
46'	372	17.03	18.20	20.20
47'	372	17.40	18.60	20.65
48'	372	17.79	18.99	21.09
49'	383	18.18	19.42	21.56
50'	383	18.56	19.83	22.01
51'	383	18.93	20.23	22.46

Reactions are DL1 + DL2 from BR202 (Simple Span).

# Bridge Manual

**P/S Concrete Double-Tee Girders - Sec. 3.56**

**Page: 1.4-13**

**32'-10" ROADWAY - BEAM TYPE 30 (HS20 & HS20 MILITARY) Superstructure  
GIRDER CAMBER**

Length Bent Span Seq	Girder No. Seq.	Interior Girder				Exterior Girder			
		Girder Camber without Slab		Girder Camber with Slab		Girder Camber without Slab		Girder Camber with Slab	
		1/2 pt.	1/4 pt.	1/2 pt.	1/4 pt.	1/2 pt.	1/4 pt.	1/2 pt.	1/4 pt.
20'	320	1/16"	1/16"	1/16"	1/16"	1/16"	1/16"	1/16"	1/16"
21'	320	1/16"	1/16"	1/16"	1/16"	1/16"	1/16"	1/16"	1/16"
22'	320	1/8"	1/16"	1/16"	1/16"	1/8"	1/16"	1/16"	1/16"
23'	320	1/8"	1/16"	1/16"	1/16"	1/8"	1/16"	1/16"	1/16"
24'	320	1/8"	1/16"	1/8"	1/16"	1/8"	1/16"	1/8"	1/16"
25'	320	1/8"	1/16"	1/8"	1/16"	1/8"	1/16"	1/8"	1/16"
26'	320	1/8"	1/16"	1/8"	1/16"	1/8"	1/16"	1/8"	1/16"
27'	330	3/16"	1/8"	3/16"	1/8"	3/16"	1/8"	3/16"	1/8"
28'	330	3/16"	1/8"	3/16"	1/8"	3/16"	1/8"	3/16"	1/8"
29'	330	1/4"	3/16"	3/16"	1/8"	1/4"	3/16"	3/16"	1/8"
30'	330	1/4"	3/16"	3/16"	1/8"	1/4"	3/16"	3/16"	1/8"
31'	330	1/4"	3/16"	3/16"	1/8"	1/4"	3/16"	3/16"	1/8"
32'	330	1/4"	3/16"	1/4"	1/8"	1/4"	3/16"	1/4"	1/8"
33'	330	1/4"	3/16"	1/4"	3/16"	1/4"	3/16"	1/4"	3/16"
34'	340	7/16"	5/16"	3/8"	1/4"	7/16"	5/16"	3/8"	1/4"
35'	340	7/16"	5/16"	3/8"	1/4"	7/16"	5/16"	3/8"	1/4"
36'	340	7/16"	5/16"	3/8"	1/4"	7/16"	5/16"	3/8"	1/4"
37'	340	7/16"	5/16"	3/8"	1/4"	7/16"	5/16"	3/8"	1/4"
38'	340	7/16"	5/16"	3/8"	1/4"	7/16"	5/16"	3/8"	1/4"
39'	340	1/2"	5/16"	3/8"	1/4"	1/2"	5/16"	3/8"	1/4"
40'	351	5/8"	7/16"	1/2"	3/8"	5/8"	7/16"	1/2"	3/8"
41'	351	5/8"	7/16"	9/16"	3/8"	5/8"	7/16"	9/16"	3/8"
42'	351	11/16"	7/16"	9/16"	3/8"	11/16"	7/16"	9/16"	3/8"
43'	351	11/16"	1/2"	9/16"	3/8"	11/16"	1/2"	9/16"	3/8"
44'	362	13/16"	9/16"	5/8"	7/16"	13/16"	9/16"	5/8"	7/16"
45'	362	13/16"	9/16"	5/8"	7/16"	13/16"	9/16"	5/8"	7/16"
46'	372	1"	11/16"	13/16"	9/16"	1"	11/16"	13/16"	9/16"
47'	372	1"	11/16"	13/16"	9/16"	1"	11/16"	13/16"	9/16"
48'	372	1"	3/4"	13/16"	9/16"	1"	3/4"	13/16"	9/16"
49'	383	1-3/16"	7/8"	1"	3/4"	1-3/16"	7/8"	1"	3/4"
50'	383	1-1/4"	7/8"	1"	3/4"	1-1/4"	7/8"	1"	3/4"
51'	383	1-1/4"	7/8"	1"	3/4"	1-1/4"	7/8"	1"	3/4"

# Bridge Manual

**P/S Concrete Double-Tee Girders – Sec. 3.56**

**Page: 1.5-1**

**36'-10" ROADWAY  
GIRDER SPAN LENGTH (HS20 & HS20 MILITARY LOADING)**

**Superstructure**

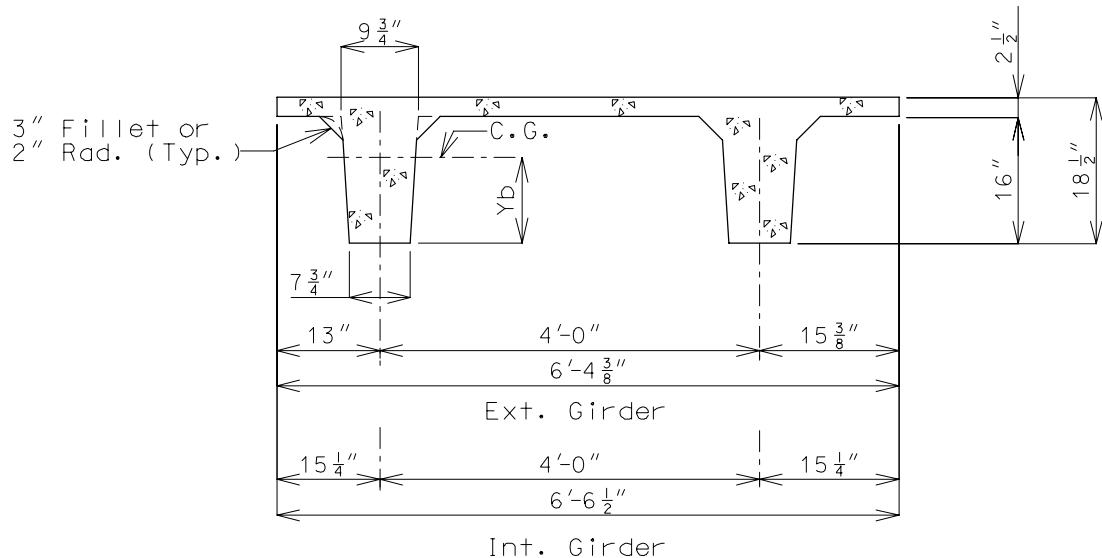
Span Length	Allowable Span Length For P/S Concrete Double-Tee Girder Spans					
	Type 30		Type 22		Type 16	
Span Length	Girder Seq. No.	Span Length	Girder Seq. No.	Span Length	Girder Seq. No.	
20'						
21'						
22'						
23'						
24'						
25'						
26'						
27'						
28'						
29'						
30'						
31'						
32'						
33'						
34'						
35'						
36'						
37'						
38'						
39'						
40'						
41'						
42'						
43'						
44'						
45'						
46'						
47'						
48'						
49'						
50'						
51'						
52'						
53'						

**Note:**

The maximum span lengths shown for P/S Double-Tee Girders are based on a minimum of 2-spans (continuous) being used. If one of these P/S Double-Tee Girders is used as one simple span, then the span lengths should be reduced from the maximum allowable span shown, and the girder design should be checked.

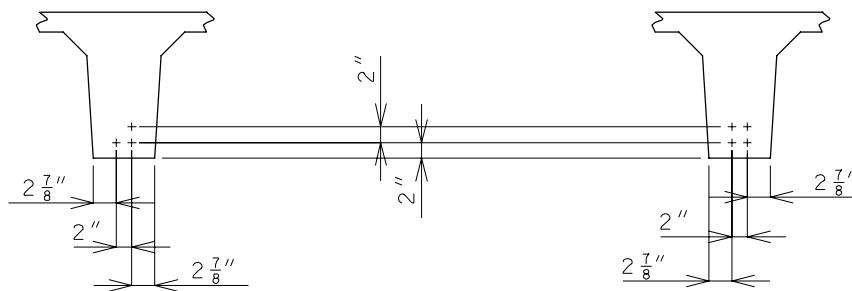
**36'-10" ROADWAY - BEAM TYPE 16 (6 GIRDER)**  
**SECTION PROPERTIES & STRAND ARRANGEMENT**

Superstructure



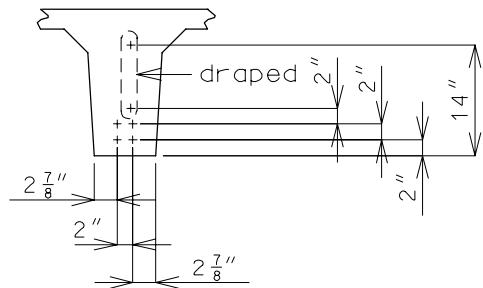
$A = 470.9$  sq. in.  
 $Y_b = 11.93$  in.  
 $I = 15,131$  in.<sup>4</sup>  
**EXTERIOR GIRDER**

$A = 476.3$  sq. in.  
 $Y_b = 12.00$  in.  
 $I = 15,282$  in.<sup>4</sup>  
**INTERIOR GIRDER**



36'-10" ROADWAY - BEAM TYPE 16 (6 GIRDER)  
SECTION PROPERTIES & STRAND ARRANGEMENT (CONT.)

Superstructure



GIRDER SEQ. NO. 151  
(5 STRANDS - 1 DRAPED)

Note: Location of draped strands shown in top of stem  
are at end of girder and draped strands in bott. of stem  
are at Q.

## Bridge Manual

P/S Concrete Double-Tee Girders - Sec. 3.56

Page: 1.5-4

36'-10" ROADWAY - BEAM TYPE 16 (HS20 & HS20 MILITARY) Superstructure  
GIRDER REACTIONS

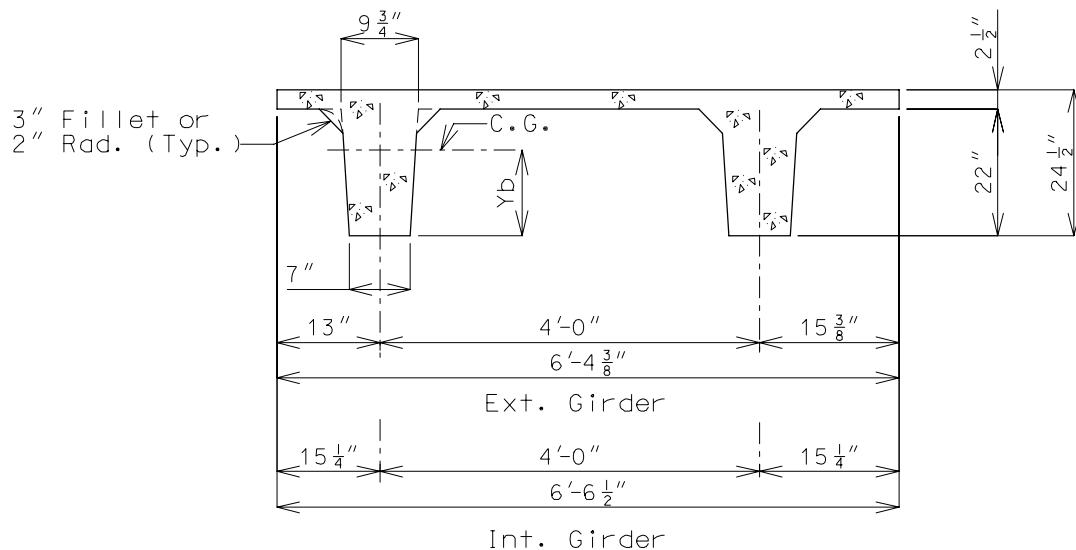
Length Span & Bent Seq	Girder No. Seq	Dead Load Reaction, kips per stem		
		Interior Girder	Exterior Girder	
			Int. Stem	Ext. Stem
20'	130	5.76	6.33	7.70
21'	130	6.07	6.67	8.10
22'	130	6.37	7.00	8.51
23'	130	6.68	7.34	8.92
24'	130	6.98	7.67	9.33
25'	140	7.29	8.01	9.73
26'	140	7.60	8.34	10.14
27'	140	7.90	8.68	10.55
28'	140	8.20	9.02	10.96
29'	151	8.51	9.35	11.36

Reactions are DL1 + DL2 from BR202 (Simple Span).



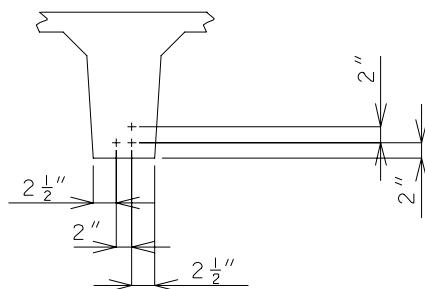
**36'-10" ROADWAY - BEAM TYPE 22 (6 GIRDER)**  
**SECTION PROPERTIES & STRAND ARRANGEMENT**

Superstructure



$A = 559.4 \text{ sq. in.}$   
 $Y_b = 15.58 \text{ in.}$   
 $I = 31,893 \text{ in.}^4$   
**EXTERIOR GIRDER**

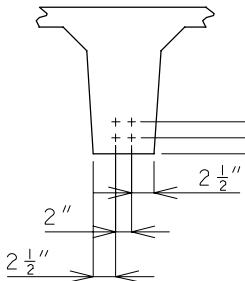
$A = 564.8 \text{ sq. in.}$   
 $Y_b = 15.65 \text{ in.}$   
 $I = 32,205 \text{ in.}^4$   
**INTERIOR GIRDER**



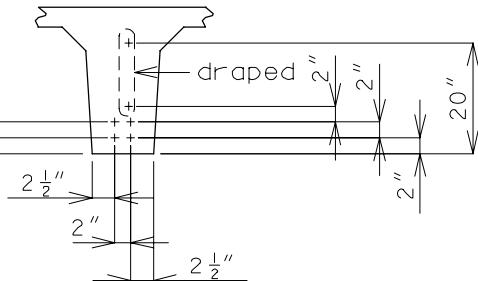
GIDERS SEQ. NO. 230  
(3 STRANDS - 0 DRAPED)

**36'-10" ROADWAY - BEAM TYPE 22**  
**SECTION PROPERTIES & STRAND ARRANGEMENT (CONT.)**

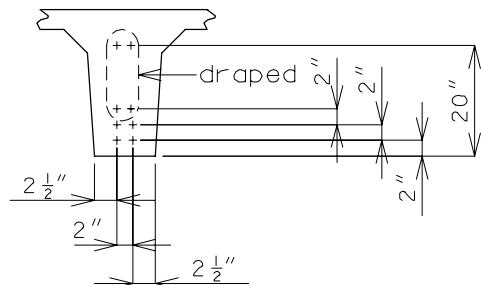
Superstructure



GIRDER SEQ. NO. 240  
 (4 STRANDS - 0 DRAPED)



GIRDER SEQ. NO. 251  
 (5 STRANDS - 1 DRAPED)



GIRDER SEQ. NO. 262  
 (6 STRANDS - 2 DRAPED)

Note: Location of draped strands shown in top of stem  
 are at end of girder and draped strands in bott. of stem  
 are at Q.

# Bridge Manual

**P/S Concrete Double-Tee Girders – Sec. 3.56**

**Page: 1.5-8**

**36'-10" ROADWAY – BEAM TYPE 22 (HS20 & HS20 MILITARY) Superstructure  
GIRDER REACTIONS**

Length Bent Span Seq.	Girder No. Seq.	Dead Load Reaction, kips per stem		
		Interior Girder	Exterior Girder	
			Int. Stem	Ext. Stem
20'	230	6.16	6.73	8.19
21'	230	6.49	7.08	8.63
22'	230	6.82	7.44	9.06
23'	230	7.14	7.80	9.50
24'	230	7.47	8.16	9.94
25'	230	7.81	8.52	10.37
26'	230	8.13	8.88	10.81
27'	230	8.46	9.23	11.25
28'	230	8.78	9.59	11.68
29'	230	9.12	9.95	12.12
30'	230	9.45	10.31	12.56
31'	240	9.77	10.67	12.99
32'	240	10.10	11.03	13.43
33'	240	10.43	11.38	13.86
34'	240	10.76	11.74	14.30
35'	240	11.08	12.10	14.74
36'	251	11.41	12.46	15.17
37'	251	11.74	12.82	15.60
38'	251	12.06	13.17	16.02
39'	262	12.39	13.53	16.46
40'	262	12.72	13.88	16.89

Reactions are DL1 + DL2 from BR202 (Simple Span).

# Bridge Manual

P/S Concrete Double-Tee Girders - Sec. 3.56

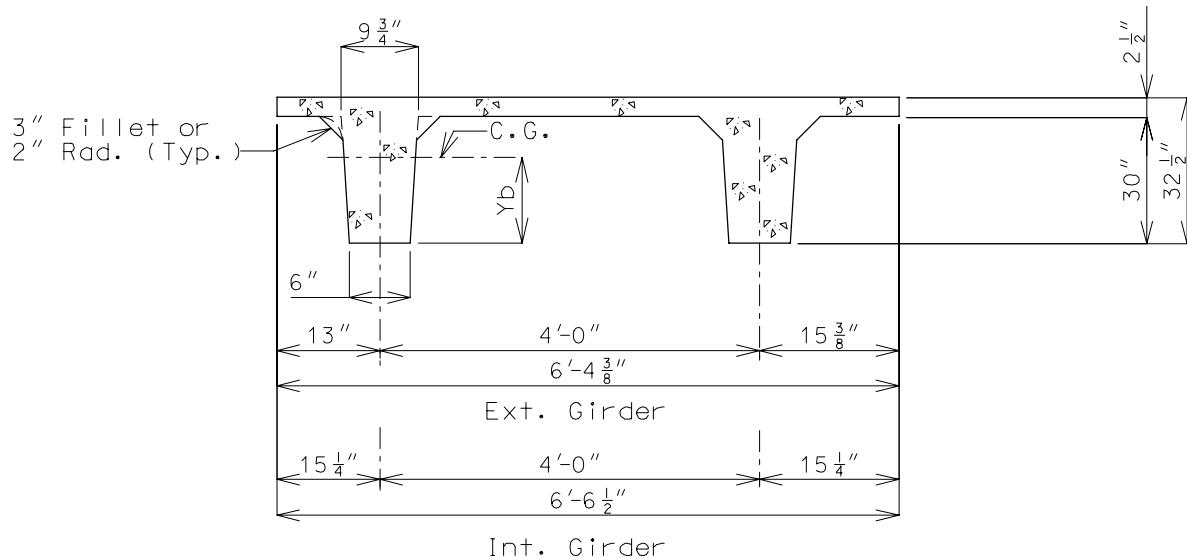
Page: 1.5-9

**36'-10" ROADWAY - BEAM TYPE 22 (HS20 & HS20 MILITARY) Superstructure  
GIRDER CAMBER**

Length Bent Span + Girder Seq.	Girder No. Seq.	Interior Girder				Exterior Girder			
		Girder Camber without Slab		Girder Camber with Slab		Girder Camber without Slab		Girder Camber with Slab	
		1/2 pt.	1/4 pt.	1/2 pt.	1/4 pt.	1/2 pt.	1/4 pt.	1/2 pt.	1/4 pt.
20'	230	3/16"	1/8"	3/16"	1/8"	3/16"	1/8"	3/16"	1/8"
21'	230	3/16"	1/8"	3/16"	1/8"	3/16"	1/8"	3/16"	1/8"
22'	230	1/4"	3/16"	3/16"	1/8"	1/4"	3/16"	3/16"	1/8"
23'	230	1/4"	3/16"	3/16"	1/8"	1/4"	3/16"	3/16"	1/8"
24'	230	1/4"	3/16"	1/4"	3/16"	1/4"	3/16"	1/4"	3/16"
25'	230	1/4"	3/16"	1/4"	3/16"	1/4"	3/16"	1/4"	3/16"
26'	230	5/16"	3/16"	1/4"	3/16"	5/16"	3/16"	1/4"	3/16"
27'	230	5/16"	3/16"	1/4"	3/16"	5/16"	3/16"	1/4"	3/16"
28'	230	5/16"	1/4"	1/4"	3/16"	5/16"	1/4"	1/4"	3/16"
29'	230	5/16"	1/4"	5/16"	3/16"	5/16"	1/4"	5/16"	3/16"
30'	230	3/8"	1/4"	5/16"	3/16"	3/8"	1/4"	5/16"	3/16"
31'	240	1/2"	3/8"	7/16"	5/16"	1/2"	3/8"	7/16"	5/16"
32'	240	9/16"	3/8"	1/2"	5/16"	9/16"	3/8"	1/2"	5/16"
33'	240	9/16"	3/8"	1/2"	5/16"	9/16"	3/8"	1/2"	5/16"
34'	240	5/8"	7/16"	1/2"	3/8"	5/8"	7/16"	1/2"	3/8"
35'	240	5/8"	7/16"	1/2"	3/8"	5/8"	7/16"	1/2"	3/8"
36'	251	3/4"	9/16"	5/8"	7/16"	3/4"	9/16"	5/8"	7/16"
37'	251	13/16"	9/16"	11/16"	1/2"	13/16"	9/16"	11/16"	1/2"
38'	251	13/16"	9/16"	11/16"	1/2"	13/16"	9/16"	11/16"	1/2"
39'	262	1"	11/16"	13/16"	9/16"	1"	11/16"	13/16"	9/16"
40'	262	1"	3/4"	13/16"	5/8"	1"	3/4"	13/16"	5/8"

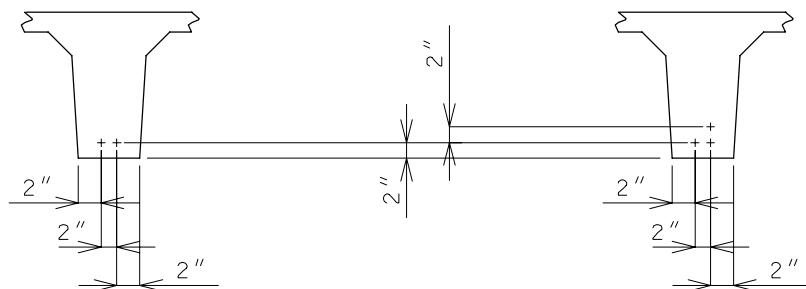
**36'-10" ROADWAY - BEAM TYPE 30 (6 GIRDER)**  
**SECTION PROPERTIES & STRAND ARRANGEMENT**

Superstructure



A = 663.4 sq. in.  
 Y<sub>b</sub> = 20.52 in.  
 I = 65,707 in.<sup>4</sup>  
**EXTERIOR GIRDER**

A = 668.8 sq. in.  
 Y<sub>b</sub> = 20.61 in.  
 I = 66,316 in.<sup>4</sup>  
**INTERIOR GIRDER**

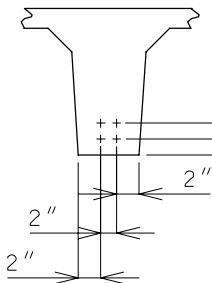


GIRDER SEQ. NO. 320  
 (2 STRANDS - 0 DRAPED)

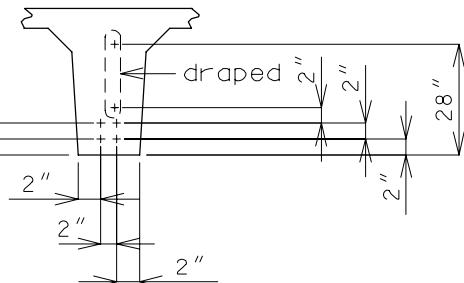
GIRDER SEQ. NO. 330  
 (3 STRANDS - 0 DRAPED)

**36'-10" ROADWAY - BEAM TYPE 30**  
**SECTION PROPERTIES & STRAND ARRANGEMENT (CONT.)**

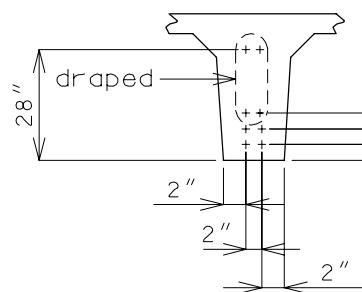
Superstructure



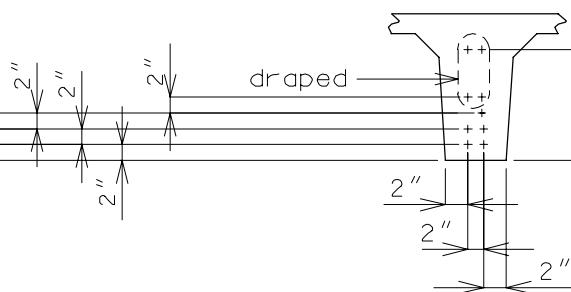
GIRDER SEQ. NO. 340  
 (4 STRANDS - 0 DRAPED)



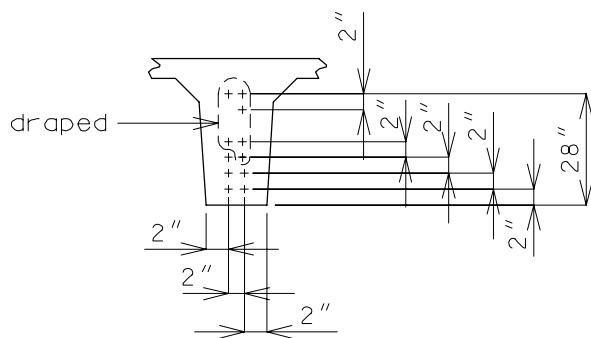
GIRDER SEQ. NO. 351  
 (5 STRANDS - 1 DRAPED)



GIRDER SEQ. NO. 362  
 (6 STRANDS - 2 DRAPED)



GIRDER SEQ. NO. 372  
 (7 STRANDS - 2 DRAPED)



GIRDER SEQ. NO. 383  
 (8 STRANDS - 3 DRAPED)

Note: Location of draped strands shown in top of stem are at end of girder and draped strands in bott. of stem are at  $\frac{1}{4}$ .

# Bridge Manual

**P/S Concrete Double-Tee Girders – Sec. 3.56**

**Page: 1.5-12**

**36'-10" ROADWAY – BEAM TYPE 30 (HS20 & HS20 MILITARY) Superstructure  
GIRDER REACTIONS**

Length Bent Span Seq	Girder No. Seq.	Dead Load Reaction, kips per stem		
		Interior Girder	Exterior Girder	
			Int. Stem	Ext. Stem
20'	320	6.59	7.14	8.48
21'	320	6.95	7.53	8.94
22'	320	7.30	7.91	9.39
23'	320	7.65	8.30	9.85
24'	320	8.01	8.69	10.31
25'	320	8.37	9.07	10.77
26'	320	8.72	9.46	11.22
27'	320	9.08	9.84	11.68
28'	320	9.43	10.23	12.14
29'	320	9.79	10.61	12.60
30'	320	10.14	11.00	13.05
31'	330	10.50	11.38	13.51
32'	330	10.85	11.77	13.97
33'	330	11.20	12.15	14.43
34'	330	11.57	12.54	14.88
35'	330	11.92	12.92	15.34
36'	340	12.27	13.31	15.80
37'	340	12.63	13.69	16.26
38'	340	12.99	14.08	16.71
39'	340	13.34	14.47	17.17
40'	340	13.69	14.85	17.63
41'	340	14.06	15.24	18.09
42'	351	14.41	15.62	18.54
43'	351	14.76	16.01	19.00
44'	351	15.11	16.39	19.46
45'	351	15.48	16.78	19.92
46'	362	15.83	17.16	20.37
47'	362	16.32	17.71	21.10
48'	372	16.68	18.10	21.56
49'	372	17.04	18.48	22.02
50'	372	17.39	18.86	22.47
51'	383	17.75	19.26	22.92
52'	383	18.11	19.65	23.39
53'	383	18.47	20.04	23.85

Reactions are DL1 + DL2 from BR202 (Simple Span).

# Bridge Manual

**P/S Concrete Double-Tee Girders - Sec. 3.56**

**Page: 1.5-13**

**36'-10" ROADWAY - BEAM TYPE 30 (HS20 & HS20 MILITARY) Superstructure  
GIRDER CAMBER**

Length Span in ft	Girder No. Seq.	Interior Girder				Exterior Girder			
		Girder Camber without Slab		Girder Camber with Slab		Girder Camber without Slab		Girder Camber with Slab	
		1/2 pt.	1/4 pt.	1/2 pt.	1/4 pt.	1/2 pt.	1/4 pt.	1/2 pt.	1/4 pt.
20'	320	1/16"	1/16"	1/16"	1/16"	1/16"	1/16"	1/16"	1/16"
21'	320	1/16"	1/16"	1/16"	1/16"	1/16"	1/16"	1/16"	1/16"
22'	320	1/8"	1/16"	1/16"	1/16"	1/8"	1/16"	1/16"	1/16"
23'	320	1/8"	1/16"	1/16"	1/16"	1/8"	1/16"	1/16"	1/16"
24'	320	1/8"	1/16"	1/8"	1/16"	1/8"	1/16"	1/8"	1/16"
25'	320	1/8"	1/16"	1/8"	1/16"	1/8"	1/16"	1/8"	1/16"
26'	320	1/8"	1/16"	1/8"	1/16"	1/8"	1/16"	1/8"	1/16"
27'	320	1/8"	1/16"	1/8"	1/16"	1/8"	1/16"	1/8"	1/16"
28'	320	1/8"	1/8"	1/8"	1/16"	1/8"	1/8"	1/8"	1/16"
29'	320	1/8"	1/8"	1/8"	1/16"	1/8"	1/8"	1/8"	1/16"
30'	320	1/8"	1/8"	1/8"	1/16"	1/8"	1/8"	1/8"	1/16"
31'	330	1/4"	3/16"	1/4"	3/16"	1/4"	3/16"	1/4"	3/16"
32'	330	1/4"	3/16"	1/4"	3/16"	1/4"	3/16"	1/4"	3/16"
33'	330	1/4"	3/16"	1/4"	3/16"	1/4"	3/16"	1/4"	3/16"
34'	330	5/16"	3/16"	1/4"	3/16"	5/16"	3/16"	1/4"	3/16"
35'	330	5/16"	3/16"	1/4"	3/16"	5/16"	3/16"	1/4"	3/16"
36'	340	7/16"	5/16"	3/8"	1/4"	7/16"	5/16"	3/8"	1/4"
37'	340	7/16"	5/16"	3/8"	1/4"	7/16"	5/16"	3/8"	1/4"
38'	340	1/2"	3/8"	7/16"	5/16"	1/2"	3/8"	7/16"	5/16"
39'	340	1/2"	3/8"	7/16"	5/16"	1/2"	3/8"	7/16"	5/16"
40'	340	1/2"	3/8"	7/16"	5/16"	1/2"	3/8"	7/16"	5/16"
41'	340	9/16"	3/8"	7/16"	5/16"	9/16"	3/8"	7/16"	5/16"
42'	351	11/16"	1/2"	9/16"	3/8"	11/16"	1/2"	9/16"	3/8"
43'	351	11/16"	1/2"	9/16"	3/8"	11/16"	1/2"	9/16"	3/8"
44'	351	11/16"	1/2"	9/16"	7/16"	11/16"	1/2"	9/16"	7/16"
45'	351	3/4"	1/2"	9/16"	7/16"	3/4"	1/2"	9/16"	7/16"
46'	362	7/8"	5/8"	3/4"	1/2"	7/8"	5/8"	3/4"	1/2"
47'	362	7/8"	5/8"	3/4"	1/2"	7/8"	5/8"	3/4"	1/2"
48'	372	1"	3/4"	7/8"	5/8"	1"	3/4"	7/8"	5/8"
49'	372	1-1/16"	3/4"	7/8"	5/8"	1-1/16"	3/4"	7/8"	5/8"
50'	372	1-1/16"	3/4"	7/8"	5/8"	1-1/16"	3/4"	7/8"	5/8"
51'	383	1-1/16"	3/4"	7/8"	5/8"	1-1/16"	3/4"	7/8"	5/8"
52'	383	1-5/16"	15/16"	1-1/16"	3/4"	1-5/16"	15/16"	1-1/16"	3/4"
53'	383	1-5/16"	15/16"	1-1/16"	3/4"	1-5/16"	15/16"	1-1/16"	3/4"

# Bridge Manual

**P/S Concrete Double-Tee Girders – Sec. 3.56**

**Page: 1.6-1**

**38'-10" ROADWAY  
GIRDER SPAN LENGTH (HS20 & HS20 MILITARY LOADING)**

**Superstructure**

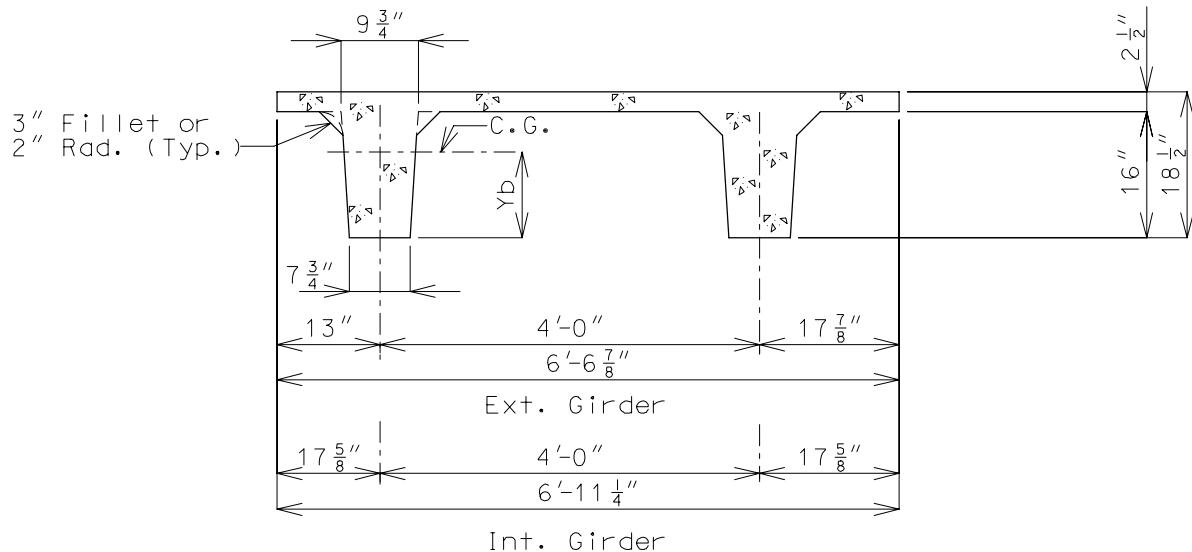
Span Length	Allowable Span Length For P/S Concrete Double-Tee Girder Spans					
	Type 30		Type 22		Type 16	
Span Length	Girder Seq. No.	Span Length	Girder Seq. No.	Span Length	Girder Seq. No.	
20'						
21'						
22'						
23'						
24'						
25'						
26'						
27'						
28'						
29'						
30'						
31'						
32'						
33'						
34'						
35'						
36'						
37'						
38'						
39'						
40'						
41'						
42'						
43'						
44'						
45'						
46'						
47'						
48'						
49'						
50'						
51'						
52'						

**Note:**

The maximum span lengths shown for P/S Double-Tee Girders are based on a minimum of 2-spans (continuous) being used. If one of these P/S Double-Tee Girders is used as one simple span, then the span lengths should be reduced from the maximum allowable span shown, and the girder design should be checked.

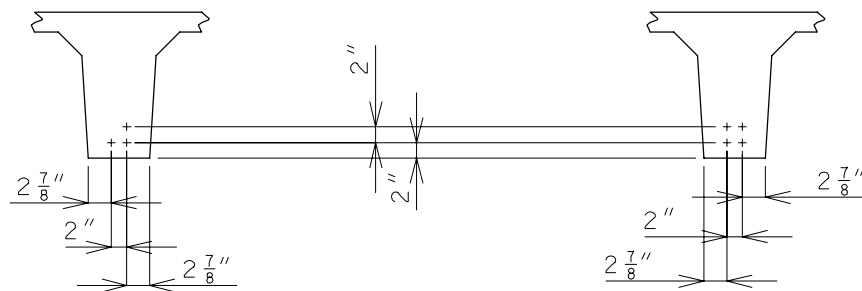
**38'-10" ROADWAY - BEAM TYPE 16 (6 GIRDER)**  
**SECTION PROPERTIES & STRAND ARRANGEMENT**

Superstructure



$A = 477.2 \text{ sq. in.}$   
 $Y_b = 12.00 \text{ in.}$   
 $I = 15,308 \text{ in.}^4$   
**EXTERIOR GIRDER**

$A = 488.1 \text{ sq. in.}$   
 $Y_b = 12.12 \text{ in.}$   
 $I = 15,609 \text{ in.}^4$   
**INTERIOR GIRDER**

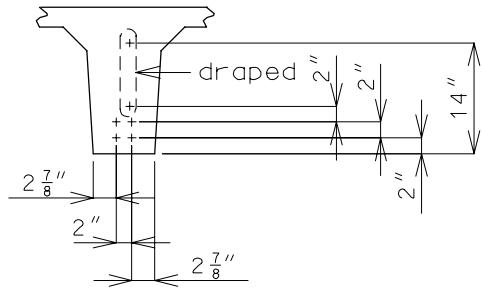


**GIRDER SEQ. NO. 130**  
(3 STRANDS - 0 DRAPED)

**GIRDER SEQ. NO. 140**  
(4 STRANDS - 0 DRAPED)

38'-10" ROADWAY - BEAM TYPE 16 (6 GIRDER)  
SECTION PROPERTIES & STRAND ARRANGEMENT (CONT.)

Superstructure



GIRDER SEQ. NO. 151  
(5 STRANDS - 1 DRAPED)

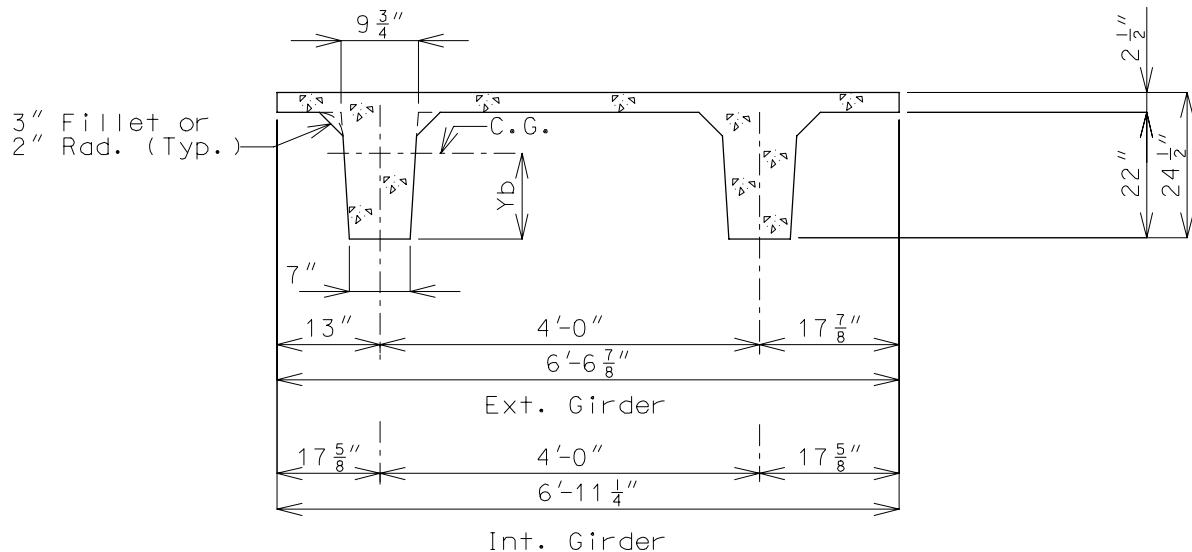
Note: Location of draped strands shown in top of stem  
are at end of girder and draped strands in bott. of stem  
are at Q.





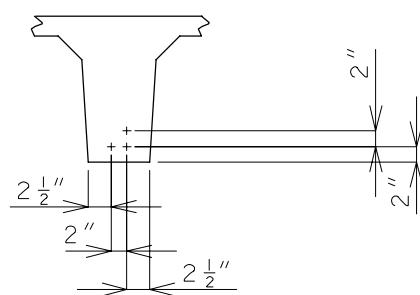
**38'-10" ROADWAY - BEAM TYPE 22 (6 GIRDER)**  
**SECTION PROPERTIES & STRAND ARRANGEMENT**

Superstructure



$A = 565.7$  sq. in.  
 $Y_b = 15.66$  in.  
 $I = 32,260$  in.<sup>4</sup>  
**EXTERIOR GIRDER**

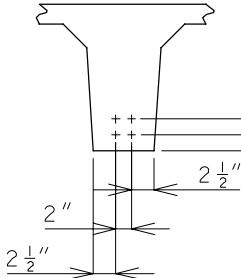
$A = 576.6$  sq. in.  
 $Y_b = 15.81$  in.  
 $I = 32,883$  in.<sup>4</sup>  
**INTERIOR GIRDER**



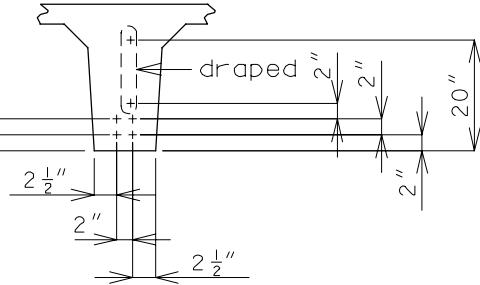
GIRDER SEQ. NO. 230  
(3 STRANDS - 0 DRAPED)

**38'-10" ROADWAY - BEAM TYPE 22**  
**SECTION PROPERTIES & STRAND ARRANGEMENT (CONT.)**

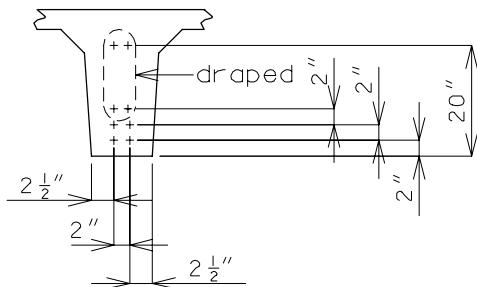
Superstructure



GIRDER SEQ. NO. 240  
 (4 STRANDS - 0 DRAPED)



GIRDER SEQ. NO. 251  
 (5 STRANDS - 1 DRAPED)



GIRDER SEQ. NO. 262  
 (6 STRANDS - 2 DRAPED)

Note: Location of draped strands shown in top of stem  
 are at end of girder and draped strands in bott. of stem  
 are at Q.

# Bridge Manual

**P/S Concrete Double-Tee Girders – Sec. 3.56**

**Page: 1.6-8**

**38'-10" ROADWAY – BEAM TYPE 22 (HS20 & HS20 MILITARY) Superstructure  
GIRDER REACTIONS**

Length + Span + Seq.	Girder No. Seq.	Dead Load Reaction, kips per stem		
		Interior Girder	Exterior Girder	
			Int. Stem	Ext. Stem
20'	230	6.50	6.98	8.23
21'	230	6.85	7.35	8.67
22'	230	7.19	7.72	9.11
23'	230	7.54	8.09	9.54
24'	230	7.88	8.46	9.98
25'	230	8.23	8.83	10.41
26'	230	8.57	9.19	10.85
27'	230	8.92	9.57	11.28
28'	230	9.26	9.93	11.72
29'	230	9.61	10.30	12.16
30'	240	9.95	10.67	12.59
31'	240	10.30	11.04	13.03
32'	240	10.64	11.41	13.46
33'	240	10.99	11.78	13.90
34'	240	11.33	12.15	14.33
35'	251	11.68	12.52	14.77
36'	251	12.02	12.88	15.21
37'	251	12.36	13.25	15.63
38'	262	12.69	13.62	16.06
39'	262	13.05	13.99	16.49

Reactions are DL1 + DL2 from BR202 (Simple Span).

# Bridge Manual

**P/S Concrete Double-Tee Girders - Sec. 3.56**

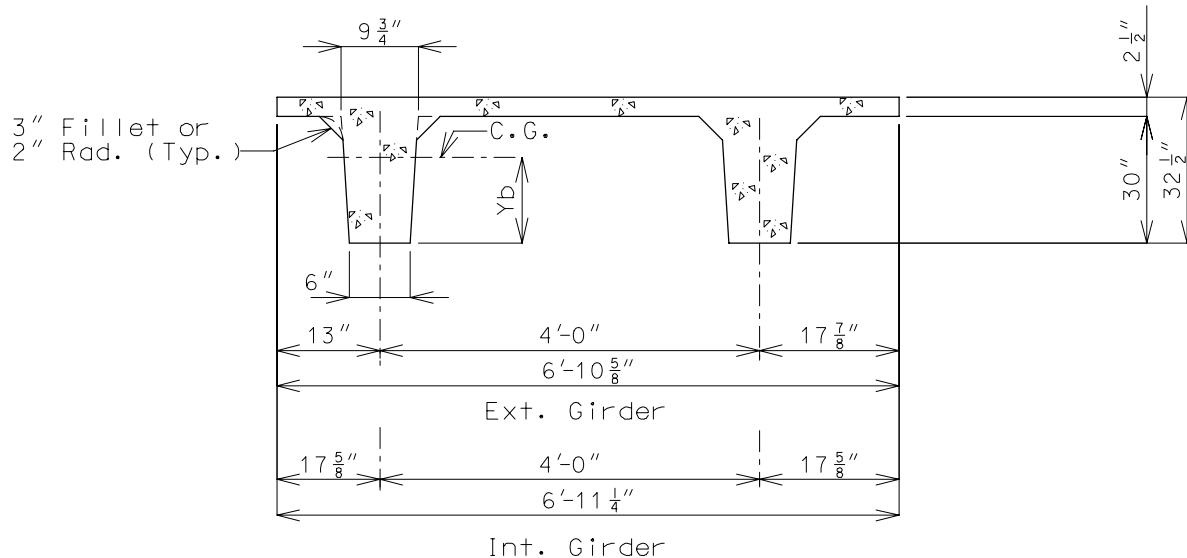
**Page: 1.6-9**

**38'-10" ROADWAY - BEAM TYPE 22 (HS20 & HS20 MILITARY) Superstructure  
GIRDER CAMBER**

Length Span + Bent Length	Girder Seq. No.	Interior Girder				Exterior Girder			
		Girder Camber without Slab		Girder Camber with Slab		Girder Camber without Slab		Girder Camber with Slab	
		1/2 pt.	1/4 pt.	1/2 pt.	1/4 pt.	1/2 pt.	1/4 pt.	1/2 pt.	1/4 pt.
20'	230	3/16"	1/8"	3/16"	1/8"	3/16"	1/8"	3/16"	1/8"
21'	230	3/16"	1/8"	3/16"	1/8"	3/16"	1/8"	3/16"	1/8"
22'	230	3/16"	1/8"	3/16"	1/8"	3/16"	1/8"	3/16"	1/8"
23'	230	1/4"	3/16"	3/16"	1/8"	1/4"	3/16"	3/16"	1/8"
24'	230	1/4"	3/16"	1/4"	3/16"	1/4"	3/16"	1/4"	3/16"
25'	230	1/4"	3/16"	1/4"	3/16"	1/4"	3/16"	1/4"	3/16"
26'	230	1/4"	3/16"	1/4"	3/16"	1/4"	3/16"	1/4"	3/16"
27'	230	5/16"	3/16"	1/4"	3/16"	5/16"	3/16"	1/4"	3/16"
28'	230	5/16"	1/4"	1/4"	3/16"	5/16"	1/4"	1/4"	3/16"
29'	230	5/16"	1/4"	5/16"	3/16"	5/16"	1/4"	5/16"	3/16"
30'	240	7/16"	5/16"	7/16"	5/16"	7/16"	5/16"	7/16"	5/16"
31'	240	1/2"	3/8"	7/16"	5/16"	1/2"	3/8"	7/16"	5/16"
32'	240	9/16"	3/8"	7/16"	5/16"	9/16"	3/8"	7/16"	5/16"
33'	240	9/16"	3/8"	1/2"	3/8"	9/16"	3/8"	1/2"	3/8"
34'	240	9/16"	7/16"	1/2"	3/8"	9/16"	7/16"	1/2"	3/8"
35'	251	3/4"	1/2"	5/8"	7/16"	3/4"	1/2"	5/8"	7/16"
36'	251	3/4"	9/16"	5/8"	7/16"	3/4"	9/16"	5/8"	7/16"
37'	251	3/4"	9/16"	5/8"	7/16"	3/4"	9/16"	5/8"	7/16"
38'	262	15/16"	11/16"	13/16"	9/16"	15/16"	11/16"	13/16"	9/16"
39'	262	1"	11/16"	13/16"	9/16"	1"	11/16"	13/16"	9/16"

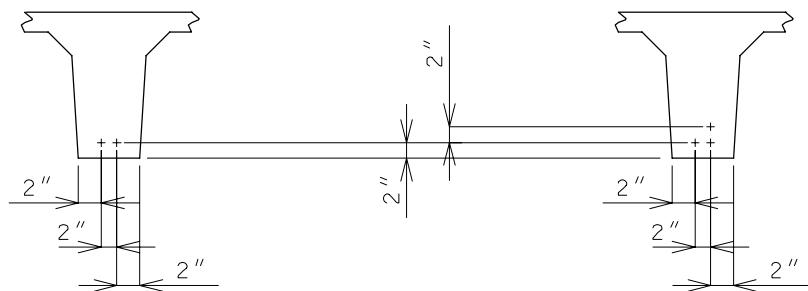
**38'-10" ROADWAY - BEAM TYPE 30 (6 GIRDER)**  
**SECTION PROPERTIES & STRAND ARRANGEMENT**

Superstructure



$A = 669.7 \text{ sq. in.}$   
 $Y_b = 20.62 \text{ in.}$   
 $I = 66,423 \text{ in.}^4$   
**EXTERIOR GIRDER**

$A = 680.6 \text{ sq. in.}$   
 $Y_b = 20.80 \text{ in.}$   
 $I = 67,644 \text{ in.}^4$   
**INTERIOR GIRDER**

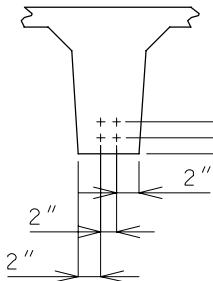


GIRDER SEQ. NO. 320  
(2 STRANDS - 0 DRAPED)

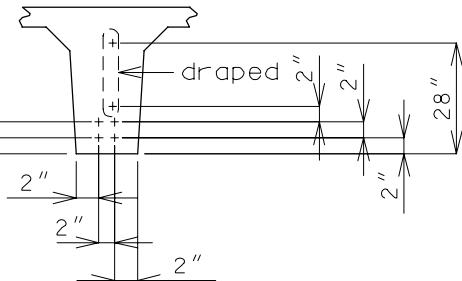
GIRDER SEQ. NO. 330  
(3 STRANDS - 0 DRAPED)

**38'-10" ROADWAY - BEAM TYPE 30**  
**SECTION PROPERTIES & STRAND ARRANGEMENT (CONT.)**

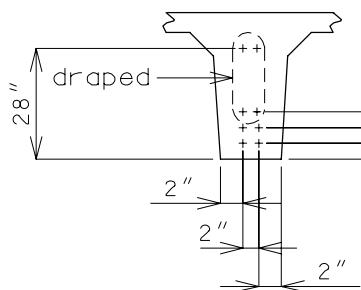
Superstructure



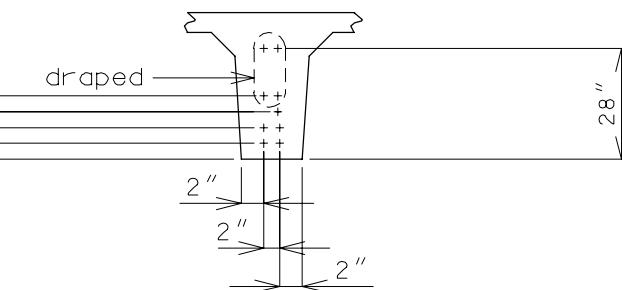
GIRDER SEQ. NO. 340  
 (4 STRANDS - 0 DRAPED)



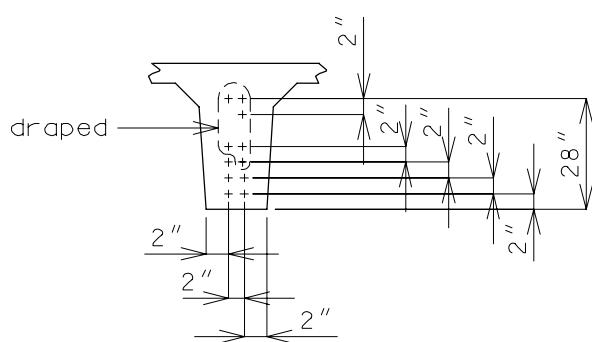
GIRDER SEQ. NO. 351  
 (5 STRANDS - 1 DRAPED)



GIRDER SEQ. NO. 362  
 (6 STRANDS - 2 DRAPED)



GIRDER SEQ. NO. 372  
 (7 STRANDS - 2 DRAPED)



GIRDER SEQ. NO. 383  
 (8 STRANDS - 3 DRAPED)

Note: Location of draped strands shown in top of stem  
 are at end of girder and draped strands in bott. of stem  
 are at £.

# Bridge Manual

**P/S Concrete Double-Tee Girders – Sec. 3.56**

**Page: 1.6-12**

**38'-10" ROADWAY – BEAM TYPE 30 (HS20 & HS20 MILITARY) Superstructure  
GIRDER REACTIONS**

Length Bent Span Seq	Girder No. Seq.	Dead Load Reaction, kips per stem		
		Interior Girder	Exterior Girder	
			Int. Stem	Ext. Stem
20'	320	6.89	7.35	8.58
21'	320	7.26	7.74	9.04
22'	320	7.63	8.14	9.50
23'	320	8.01	8.54	9.97
24'	320	8.37	8.93	10.43
25'	320	8.75	9.33	10.89
26'	320	9.12	9.73	11.36
27'	320	9.49	10.12	11.82
28'	320	9.86	10.52	12.28
29'	330	10.24	10.92	12.74
30'	330	10.60	11.31	13.21
31'	330	10.98	11.71	13.67
32'	330	11.35	12.11	14.13
33'	330	11.73	12.50	14.59
34'	330	12.09	12.90	15.06
35'	340	12.47	13.29	15.52
36'	340	12.84	13.69	15.98
37'	340	13.20	14.09	16.45
38'	340	13.58	14.48	16.91
39'	340	13.95	14.88	17.37
40'	340	14.32	15.28	17.83
41'	351	14.69	15.67	18.30
42'	351	15.06	16.07	18.76
43'	351	15.43	16.47	19.22
44'	351	15.81	16.86	19.68
45'	362	16.18	17.26	20.15
46'	362	16.56	17.65	20.61
47'	372	16.92	18.05	21.07
48'	372	17.29	18.44	21.52
49'	372	17.66	18.83	21.98
50'	383	18.03	19.23	22.44
51'	383	18.40	19.62	22.90
52'	383	18.77	20.01	23.35

Reactions are DL1 + DL2 from BR202 (Simple Span).

# Bridge Manual

**P/S Concrete Double-Tee Girders - Sec. 3.56**

**Page: 1.6-13**

**38'-10" ROADWAY - BEAM TYPE 30 (HS20 & HS20 MILITARY) Superstructure  
GIRDER CAMBER**

Length Span in ft	Girder No. Seq.	Interior Girder				Exterior Girder			
		Girder Camber without Slab		Girder Camber with Slab		Girder Camber without Slab		Girder Camber with Slab	
		1/2 pt.	1/4 pt.	1/2 pt.	1/4 pt.	1/2 pt.	1/4 pt.	1/2 pt.	1/4 pt.
20'	320	1/16"	1/16"	1/16"	1/16"	1/16"	1/16"	1/16"	1/16"
21'	320	1/16"	1/16"	1/16"	1/16"	1/16"	1/16"	1/16"	1/16"
22'	320	1/8"	1/16"	1/16"	1/16"	1/8"	1/16"	1/16"	1/16"
23'	320	1/8"	1/16"	1/16"	1/16"	1/8"	1/16"	1/16"	1/16"
24'	320	1/8"	1/16"	1/8"	1/16"	1/8"	1/16"	1/8"	1/16"
25'	320	1/8"	1/16"	1/8"	1/16"	1/8"	1/16"	1/8"	1/16"
26'	320	1/8"	1/16"	1/8"	1/16"	1/8"	1/16"	1/8"	1/16"
27'	320	1/8"	1/16"	1/8"	1/16"	1/8"	1/16"	1/8"	1/16"
28'	320	1/8"	1/8"	1/8"	1/16"	1/8"	1/8"	1/8"	1/16"
29'	330	1/4"	3/16"	3/16"	1/8"	1/4"	3/16"	3/16"	1/8"
30'	330	1/4"	3/16"	3/16"	1/8"	1/4"	3/16"	3/16"	1/8"
31'	330	1/4"	3/16"	1/4"	3/16"	1/4"	3/16"	1/4"	3/16"
32'	330	1/4"	3/16"	1/4"	3/16"	1/4"	3/16"	1/4"	3/16"
33'	330	1/4"	3/16"	1/4"	3/16"	1/4"	3/16"	1/4"	3/16"
34'	330	5/16"	3/16"	1/4"	3/16"	5/16"	3/16"	1/4"	3/16"
35'	340	7/16"	5/16"	3/8"	1/4"	7/16"	5/16"	3/8"	1/4"
36'	340	7/16"	5/16"	3/8"	1/4"	7/16"	5/16"	3/8"	1/4"
37'	340	1/2"	5/16"	3/8"	5/16"	1/2"	5/16"	3/8"	5/16"
38'	340	1/2"	3/8"	7/16"	5/16"	1/2"	3/8"	7/16"	5/16"
39'	340	1/2"	3/8"	7/16"	5/16"	1/2"	3/8"	7/16"	5/16"
40'	340	1/2"	3/8"	7/16"	5/16"	1/2"	3/8"	7/16"	5/16"
41'	351	5/8"	7/16"	9/16"	3/8"	5/8"	7/16"	9/16"	3/8"
42'	351	11/16"	1/2"	9/16"	3/8"	11/16"	1/2"	9/16"	3/8"
43'	351	11/16"	1/2"	9/16"	3/8"	11/16"	1/2"	9/16"	3/8"
44'	351	11/16"	1/2"	9/16"	3/8"	11/16"	1/2"	9/16"	3/8"
45'	362	7/8"	5/8"	11/16"	1/2"	7/8"	5/8"	11/16"	1/2"
46'	362	7/8"	5/8"	11/16"	1/2"	7/8"	5/8"	11/16"	1/2"
47'	372	1"	11/16"	13/16"	9/16"	1"	11/16"	13/16"	9/16"
48'	372	1"	3/4"	13/16"	5/8"	1"	3/4"	13/16"	5/8"
49'	372	1-1/16"	3/4"	13/16"	5/8"	1-1/16"	3/4"	13/16"	5/8"
50'	383	1-1/4"	7/8"	1"	3/4"	1-1/4"	7/8"	1"	3/4"
51'	383	1-1/4"	7/8"	1"	3/4"	1-1/4"	7/8"	1"	3/4"
52'	383	1-5/16"	15/16"	1"	3/4"	1-5/16"	15/16"	1"	3/4"

# Bridge Manual

**P/S Concrete Double-Tee Girders – Sec. 3.56**

**Page: 1.7-1**

**42'-10" ROADWAY  
GIRDER SPAN LENGTH (HS20 & HS20 MILITARY LOADING)**

**Superstructure**

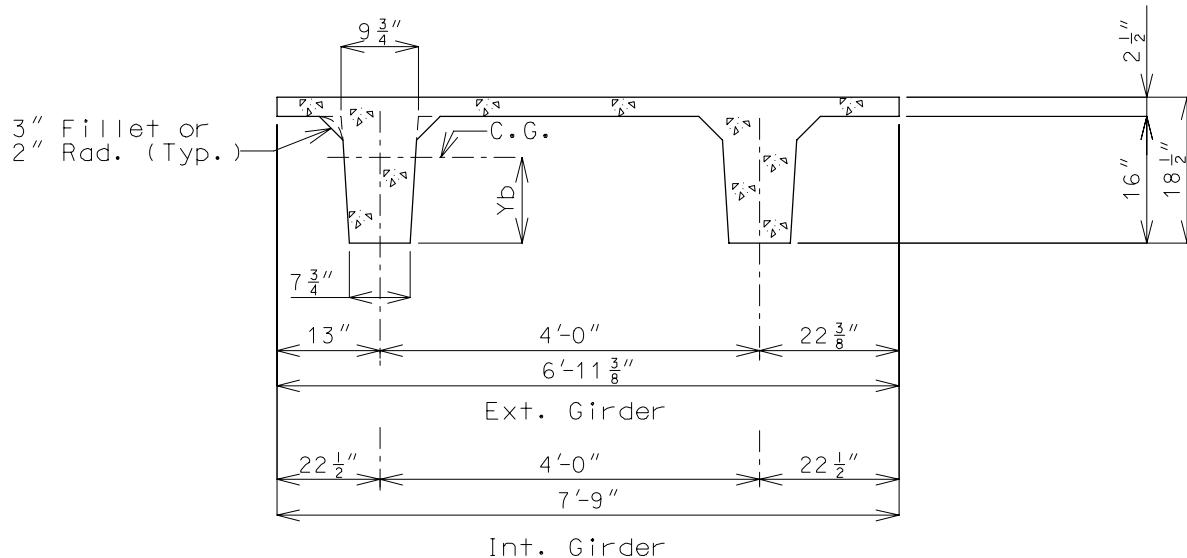
Span Length	Allowable Span Length For P/S Concrete Double-Tee Girder Spans					
	Type 30		Type 22		Type 16	
Span Length	Girder Seq. No.	Span Length	Girder Seq. No.	Span Length	Girder Seq. No.	
20'		20' thru 22'	320	20' thru 24'	230	
21'						
22'						
23'						
24'						
25'		23' thru 28'	330	25' thru 29'	240	
26'						
27'						
28'						
29'						
30'						
31'		29' thru 34'	340	30' thru 33'	251	
32'						
33'						
34'						
35'						
36'		35' thru 39'	351	34' thru 36'	262	
37'						
38'						
39'						
40'		40' thru 42'	362			
41'						
42'						
43'						
44'						
45'		43' thru 47'	383			
46'						
47'						

**Note:**

The maximum span lengths shown for P/S Double-Tee Girders are based on a minimum of 2-spans (continuous) being used. If one of these P/S Double-Tee Girders is used as one simple span, then the span lengths should be reduced from the maximum allowable span shown, and the girder design should be checked.

**42'-10" ROADWAY - BEAM TYPE 16 (6 GIRDER)**  
**SECTION PROPERTIES & STRAND ARRANGEMENT**

Superstructure



$$A = 488.4 \text{ sq. in.}$$

$$Y_b = 12.12 \text{ in.}$$

$$I = 15,617 \text{ in.}^4$$

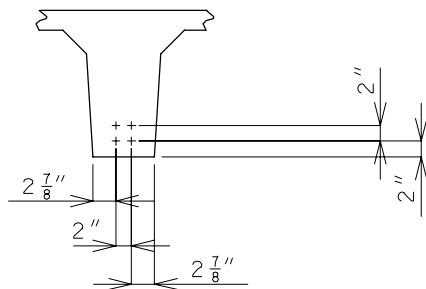
EXTERIOR GIRDER

$$A = 512.5 \text{ sq. in.}$$

$$Y_b = 12.36 \text{ in.}$$

$$I = 16,233 \text{ in.}^4$$

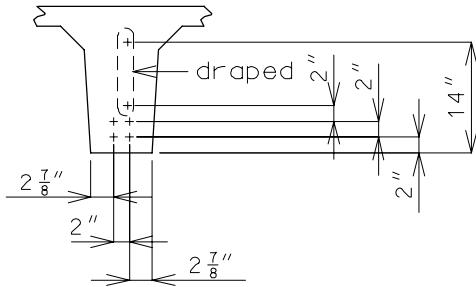
INTERIOR GIRDER



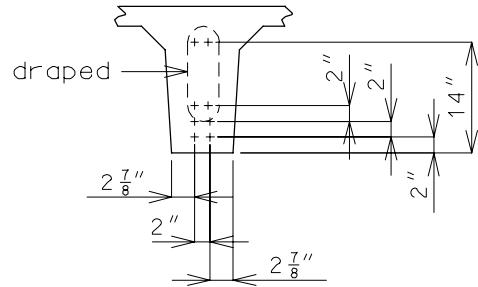
GIRDER SEQ. NO. 140  
 (4 STRANDS - 0 DRAPED)

42'-10" ROADWAY - BEAM TYPE 16 (6 GIRDER)  
SECTION PROPERTIES & STRAND ARRANGEMENT (CONT.)

Superstructure



GIRDER SEQ. NO. 151  
(5 STRANDS - 1 DRAPED)



GIRDER SEQ. NO. 162  
(6 STRANDS - 2 DRAPED)

Note: Location of draped strands shown in top of stem  
are at end of girder and draped strands in bott. of stem  
are at €.

## Bridge Manual

P/S Concrete Double-Tee Girders - Sec. 3.56

Page: 1.7-4

42'-10" ROADWAY - BEAM TYPE 16 (HS20 & HS20 MILITARY) Superstructure  
GIRDER REACTIONS

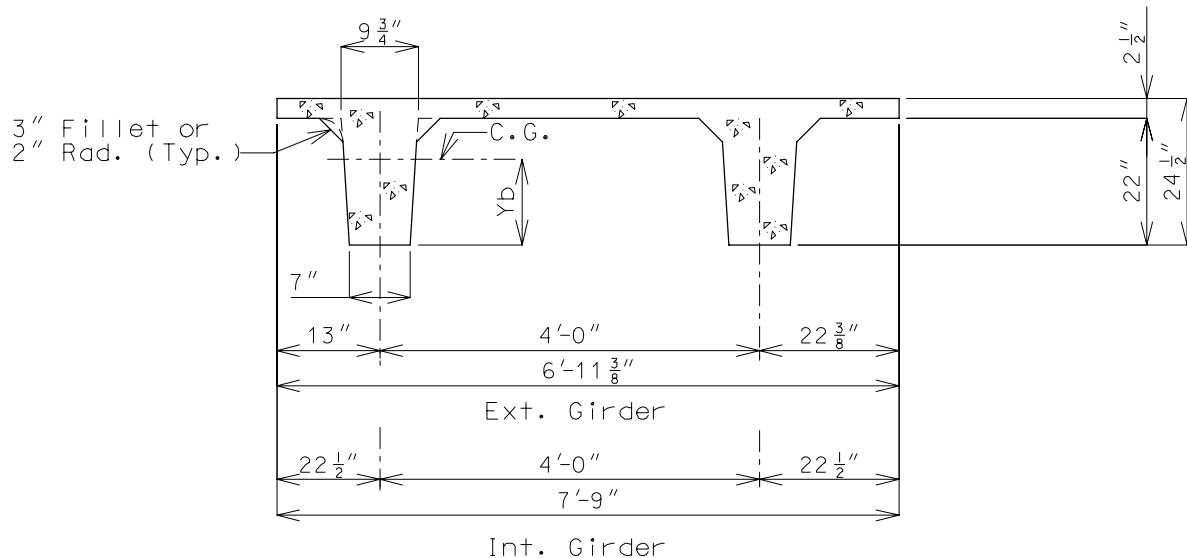
Span Length Bent Seq to	Girder No. Seq.	Dead Load Reaction, kips per stem		
		Interior Girder	Exterior Girder	
			Int. Stem	Ext. Stem
20'	140	6.49	6.93	7.77
21'	140	6.82	7.30	8.18
22'	140	7.18	7.67	8.60
23'	140	7.53	8.04	9.01
24'	140	7.87	8.41	9.43
25'	151	8.21	8.78	9.84
26'	151	8.55	9.13	10.24
27'	151	8.88	9.49	10.64
28'	162	9.22	9.85	11.04

Reactions are DL1 + DL2 from BR202 (Simple Span).



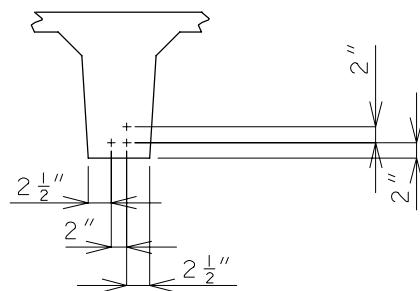
**42'-10" ROADWAY - BEAM TYPE 22 (6 GIRDER)**  
**SECTION PROPERTIES & STRAND ARRANGEMENT**

Superstructure



$A = 576.9 \text{ sq. in.}$   
 $Y_b = 15.8 \text{ in.}$   
 $I = 32,900 \text{ in.}^4$   
**EXTERIOR GIRDER**

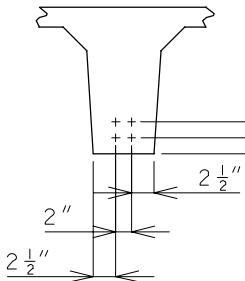
$A = 610.0 \text{ sq. in.}$   
 $Y_b = 16.1 \text{ in.}$   
 $I = 34,192 \text{ in.}^4$   
**INTERIOR GIRDER**



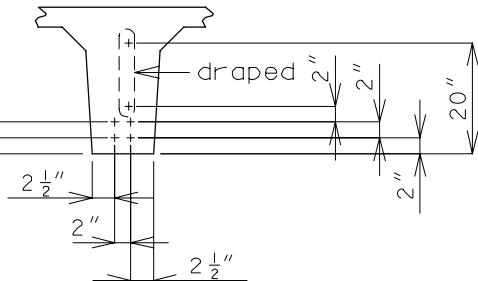
GIRDER SEQ. NO. 230  
(3 STRANDS - 0 DRAPED)

**42'-10" ROADWAY - BEAM TYPE 22**  
**SECTION PROPERTIES & STRAND ARRANGEMENT (CONT.)**

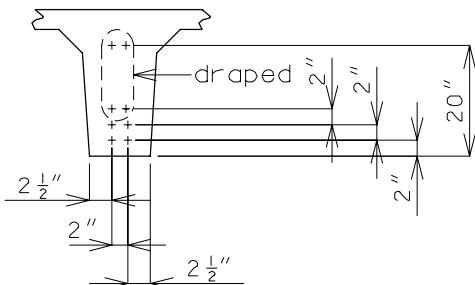
Superstructure



GIRDER SEQ. NO. 240  
 (4 STRANDS - 0 DRAPED)



GIRDER SEQ. NO. 251  
 (5 STRANDS - 1 DRAPED)



GIRDER SEQ. NO. 262  
 (6 STRANDS - 2 DRAPED)

Note: Location of draped strands shown in top of stem  
 are at end of girder and draped strands in bott. of stem  
 are at Q.

**Bridge Manual**

**P/S Concrete Double-Tee Girders – Sec. 3.56**

**Page: 1.7-8**

**42'-10" ROADWAY – BEAM TYPE 22 (HS20 & HS20 MILITARY) Superstructure  
GIRDER REACTIONS**

Length Span Seq	Girder No. Seq.	Dead Load Reaction, kips per stem		
		Interior Girder	Exterior Girder	
			Int. Stem	Ext. Stem
20'	230	6.92	7.36	8.20
21'	230	7.29	7.76	8.64
22'	230	7.66	8.15	9.08
23'	230	8.03	8.54	9.51
24'	230	8.40	8.94	9.95
25'	240	8.76	9.33	10.39
26'	240	9.13	9.72	10.83
27'	240	9.50	10.12	11.26
28'	240	9.87	10.51	11.70
29'	240	10.29	10.90	12.14
30'	251	10.61	11.29	12.58
31'	251	10.98	11.69	13.02
32'	251	11.34	12.08	13.45
33'	251	11.71	12.47	13.89
34'	262	12.08	12.87	14.33
35'	262	12.44	13.25	14.75
36'	262	12.80	13.63	15.18

Reactions are DL1 + DL2 from BR202 (Simple Span).

**Bridge Manual**

**P/S Concrete Double-Tee Girders - Sec. 3.56**

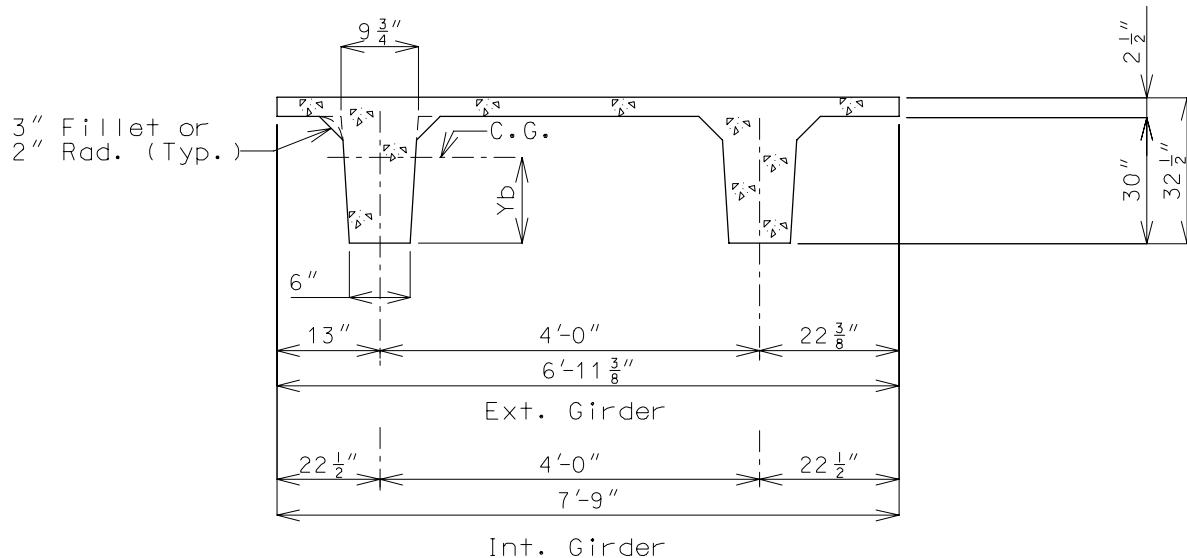
**Page: 1.7-9**

**42'-10" ROADWAY - BEAM TYPE 22 (HS20 & HS20 MILITARY) Superstructure  
GIRDER CAMBER**

Length Bent Span + Bent Length	Girder No. Seq.	Interior Girder				Exterior Girder			
		Girder Camber without Slab		Girder Camber with Slab		Girder Camber without Slab		Girder Camber with Slab	
		1/2 pt.	1/4 pt.	1/2 pt.	1/4 pt.	1/2 pt.	1/4 pt.	1/2 pt.	1/4 pt.
20'	230	3/16"	1/8"	3/16"	1/8"	3/16"	1/8"	3/16"	1/8"
21'	230	3/16"	1/8"	3/16"	1/8"	3/16"	1/8"	3/16"	1/8"
22'	230	3/16"	1/8"	3/16"	1/8"	3/16"	1/8"	3/16"	1/8"
23'	230	1/4"	3/16"	3/16"	1/8"	1/4"	3/16"	3/16"	1/8"
24'	240	1/4"	3/16"	3/16"	1/8"	1/4"	3/16"	3/16"	1/8"
25'	240	3/8"	1/4"	5/16"	1/4"	3/8"	1/4"	5/16"	1/4"
26'	240	3/8"	1/4"	5/16"	1/4"	3/8"	1/4"	5/16"	1/4"
27'	240	3/8"	5/16"	3/8"	1/4"	3/8"	5/16"	3/8"	1/4"
28'	240	7/16"	5/16"	3/8"	1/4"	7/16"	5/16"	3/8"	1/4"
29'	240	7/16"	5/16"	3/8"	1/4"	7/16"	5/16"	3/8"	1/4"
30'	251	9/16"	3/8"	1/2"	3/8"	9/16"	3/8"	1/2"	3/8"
31'	251	9/16"	7/16"	1/2"	3/8"	9/16"	7/16"	1/2"	3/8"
32'	251	5/8"	7/16"	9/16"	3/8"	5/8"	7/16"	9/16"	3/8"
33'	251	5/8"	7/16"	9/16"	3/8"	5/8"	7/16"	9/16"	3/8"
34'	262	13/16"	9/16"	11/16"	1/2"	13/16"	9/16"	11/16"	1/2"
35'	262	13/16"	9/16"	11/16"	1/2"	13/16"	9/16"	11/16"	1/2"
36'	262	7/8"	5/8"	3/4"	1/2"	7/8"	5/8"	3/4"	1/2"

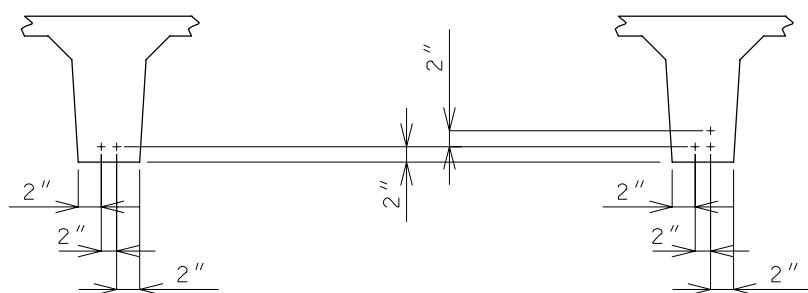
**42'-10" ROADWAY - BEAM TYPE 30 (6 GIRDER)**  
**SECTION PROPERTIES & STRAND ARRANGEMENT**

Superstructure



$A = 680.9 \text{ sq. in.}$   
 $Y_b = 20.80 \text{ in.}$   
 $I = 67,678 \text{ in.}^4$   
**EXTERIOR GIRDER**

$A = 705.0 \text{ sq. in.}$   
 $Y_b = 21.16 \text{ in.}$   
 $I = 70,228 \text{ in.}^4$   
**INTERIOR GIRDER**

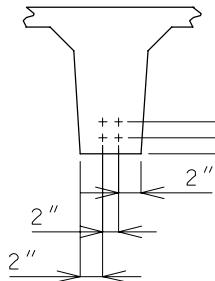


GIRDER SEQ. NO. 320  
(2 STRANDS - 0 DRAPED)

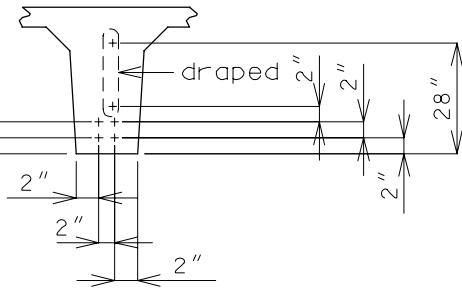
GIRDER SEQ. NO. 330  
(3 STRANDS - 0 DRAPED)

**42'-10" ROADWAY - BEAM TYPE 30**  
**SECTION PROPERTIES & STRAND ARRANGEMENT (CONT.)**

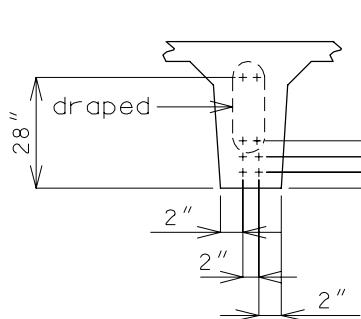
Superstructure



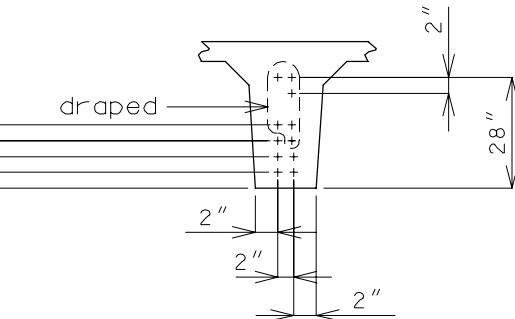
GIRDER SEQ. NO. 340  
 (4 STRANDS - 0 DRAPED)



GIRDER SEQ. NO. 351  
 (5 STRANDS - 1 DRAPED)



GIRDER SEQ. NO. 362  
 (6 STRANDS - 2 DRAPED)



GIRDER SEQ. NO. 383  
 (8 STRANDS - 3 DRAPED)

Note: Location of draped strands shown in top of stem  
 are at end of girder and draped strands in bott. of stem  
 are at £.

# Bridge Manual

**P/S Concrete Double-Tee Girders – Sec. 3.56**

**Page: 1.7-12**

**42'-10" ROADWAY – BEAM TYPE 30 (HS20 & HS20 MILITARY) Superstructure  
GIRDER REACTIONS**

Length Span Seq	Girder No. Seq.	Dead Load Reaction, kips per stem		
		Interior Girder	Exterior Girder	
			Int. Stem	Ext. Stem
20'	330	7.42	7.87	8.71
21'	320	7.82	8.29	9.17
22'	320	8.22	8.71	9.64
23'	330	8.61	9.13	10.10
24'	330	9.02	9.55	10.57
25'	330	9.40	9.97	11.03
26'	330	9.80	10.39	11.50
27'	330	10.20	10.81	11.96
28'	330	10.60	11.23	12.43
29'	340	10.99	11.65	12.89
30'	340	11.39	12.07	13.36
31'	340	11.79	12.49	13.82
32'	340	12.19	12.91	14.29
33'	340	12.57	13.33	14.75
34'	340	12.97	13.75	15.22
35'	351	13.37	14.17	15.68
36'	351	13.77	14.59	16.15
37'	351	14.16	15.00	16.61
38'	351	14.57	15.43	17.07
39'	351	14.96	15.85	17.54
40'	362	15.36	16.27	18.00
41'	362	15.74	16.69	18.47
42'	362	16.14	17.11	18.93
43'	383	16.54	17.53	19.40
44'	383	16.94	17.95	19.86
45'	383	17.32	18.37	20.33
46'	383	17.72	18.78	20.78
47'	383	18.12	19.20	21.24

Reactions are DL1 + DL2 from BR202 (Simple Span).

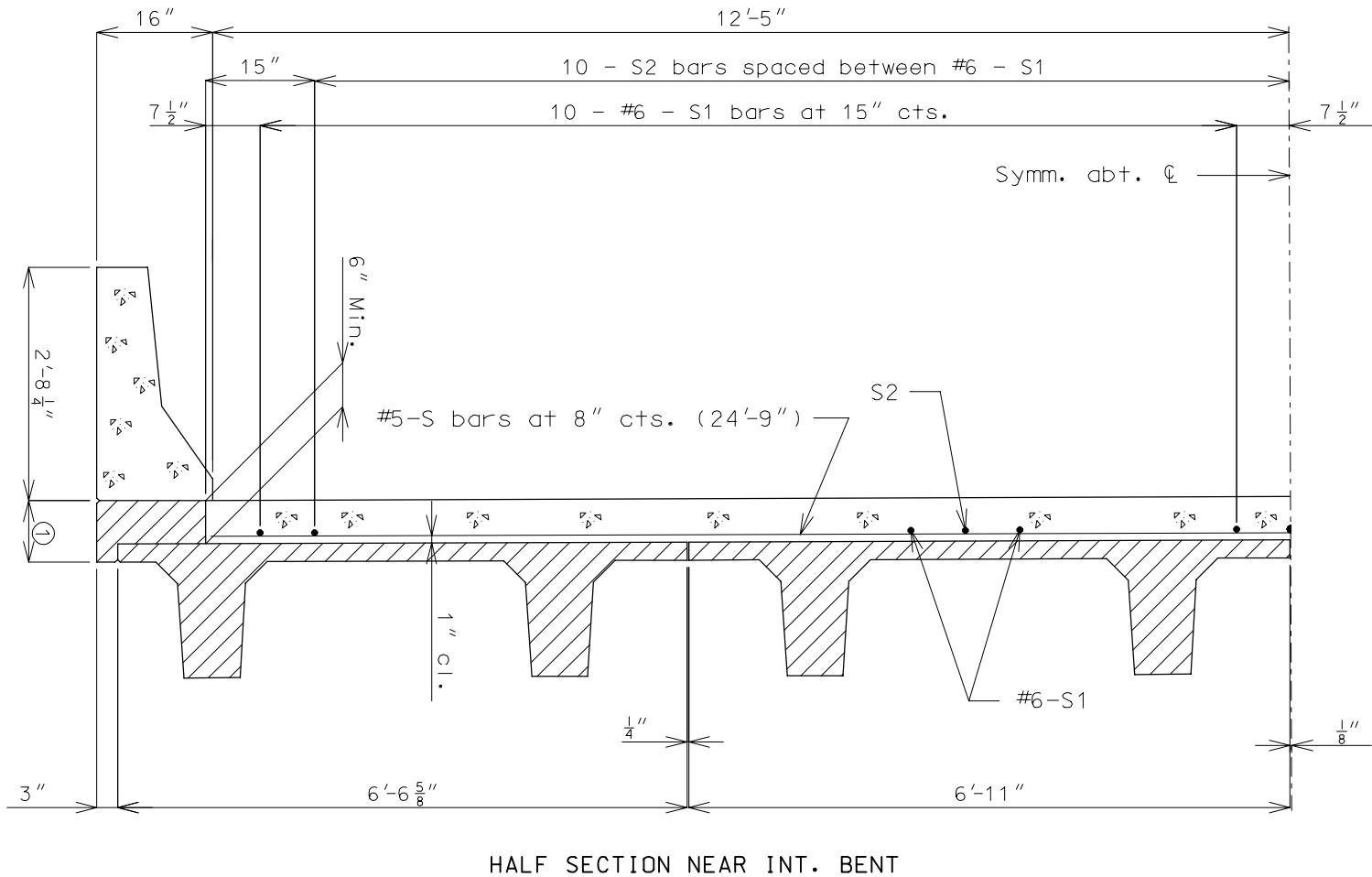
# Bridge Manual

**P/S Concrete Double-Tee Girders - Sec. 3.56**

**Page: 1.7-13**

**42'-10" ROADWAY - BEAM TYPE 30 (HS20 & HS20 MILITARY) Superstructure  
GIRDER CAMBER**

Length Span in ft	Girder No. Seq.	Interior Girder				Exterior Girder			
		Girder Camber without Slab		Girder Camber with Slab		Girder Camber without Slab		Girder Camber with Slab	
		1/2 pt.	1/4 pt.	1/2 pt.	1/4 pt.	1/2 pt.	1/4 pt.	1/2 pt.	1/4 pt.
20'	320	1/16"	1/16"	1/16"	1/16"	1/16"	1/16"	1/16"	1/16"
21'	320	1/16"	1/16"	1/16"	1/16"	1/16"	1/16"	1/16"	1/16"
22'	320	1/16"	1/16"	1/16"	1/16"	1/16"	1/16"	1/16"	1/16"
23'	330	1/8"	1/8"	1/8"	1/8"	3/16"	1/8"	1/8"	1/8"
24'	330	3/16"	1/8"	1/8"	1/8"	3/16"	1/8"	1/8"	1/8"
25'	330	3/16"	1/8"	3/16"	1/8"	3/16"	1/8"	3/16"	1/8"
26'	330	3/16"	1/8"	3/16"	1/8"	3/16"	1/8"	3/16"	1/8"
27'	330	3/16"	1/8"	3/16"	1/8"	3/16"	1/8"	3/16"	1/8"
28'	330	3/16"	1/8"	3/16"	1/8"	3/16"	1/8"	3/16"	1/8"
29'	340	5/16"	1/4"	5/16"	3/16"	5/16"	1/4"	5/16"	3/16"
30'	340	5/16"	1/4"	5/16"	3/16"	5/16"	1/4"	5/16"	3/16"
31'	340	3/8"	1/4"	5/16"	1/4"	3/8"	1/4"	5/16"	1/4"
32'	340	3/8"	1/4"	5/16"	1/4"	3/8"	1/4"	5/16"	1/4"
33'	340	3/8"	1/4"	5/16"	1/4"	3/8"	1/4"	5/16"	1/4"
34'	340	3/8"	1/4"	5/16"	1/4"	3/8"	1/4"	5/16"	1/4"
35'	351	1/2"	3/8"	7/16"	5/16"	1/2"	3/8"	7/16"	5/16"
36'	351	1/2"	3/8"	1/2"	5/16"	1/2"	3/8"	1/2"	5/16"
37'	351	9/16"	3/8"	1/2"	3/8"	9/16"	3/8"	1/2"	3/8"
38'	351	9/16"	7/16"	1/2"	3/8"	9/16"	7/16"	1/2"	3/8"
39'	351	9/16"	7/16"	1/2"	3/8"	9/16"	7/16"	1/2"	3/8"
40'	362	3/4"	1/2"	5/8"	7/16"	3/4"	1/2"	5/8"	7/16"
41'	362	3/4"	1/2"	5/8"	7/16"	3/4"	1/2"	5/8"	7/16"
42'	362	3/4"	9/16"	5/8"	7/16"	3/4"	9/16"	5/8"	7/16"
43'	383	1"	3/4"	7/8"	5/8"	1"	3/4"	7/8"	5/8"
44'	383	1-1/16"	3/4"	15/16"	11/16"	1-1/16"	3/4"	15/16"	11/16"
45'	383	1-1/16"	3/4"	15/16"	11/16"	1-1/16"	3/4"	15/16"	11/16"
46'	383	1-1/8"	13/16"	15/16"	11/16"	1-1/8"	13/16"	15/16"	11/16"
47'	383	1-1/8"	13/16"	15/16"	11/16"	1-1/8"	13/16"	15/16"	11/16"



① 2-1/2" + Theoretical slab thickness.

Note: S2 bars at Int. Bents for negative moment reinforcement.

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24'-10" ROADWAY (HS20 & HS20 MILITARY)  
SLAB REINFORCEMENT (CONT.)

Reinforcement

## NEGATIVE MOMENT REINFORCEMENT

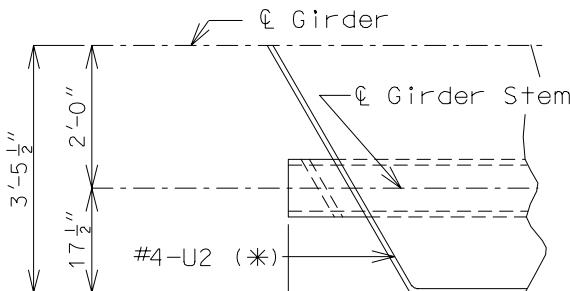
ADDITIONAL BARS (S2) OVER INT. BENTS			
Girder Seq. No.	No. of add bars	Size of Neg. Mom. Reinf.	Length (*)
130	19	#5	8'-0"
140	19	#5	8'-0"
151	19	#7	8'-0"
230	19	#5	8'-0"
240	19	#5	8'-0"
251	19	#5	8'-0"
262	19	#5	8'-0"
320	19	#5	8'-0"
330	19	#5	8'-0"
340	19	#5	8'-0"
351	19	#5	8'-0"
362	19	#7	8'-0"
372	19	#7	10'-0"
383	19	#7	15'-0"

\* Length each side from £ Int. Bent. For unequal spans use greater length on both sides of Int. Bent.

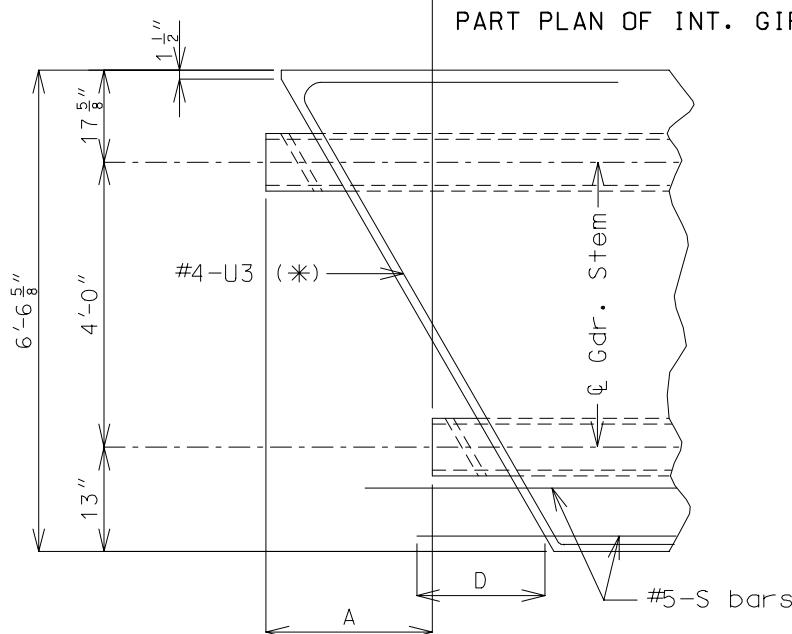
24'-10" ROADWAY (HS20 & HS20 MILITARY)  
SLAB REINFORCEMENT (CONT.)

Reinforcement

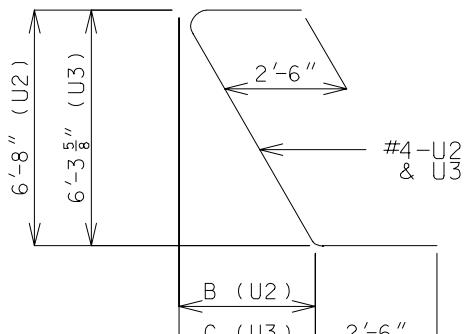
\* Skewed Girders



PART PLAN OF INT. GIRDER



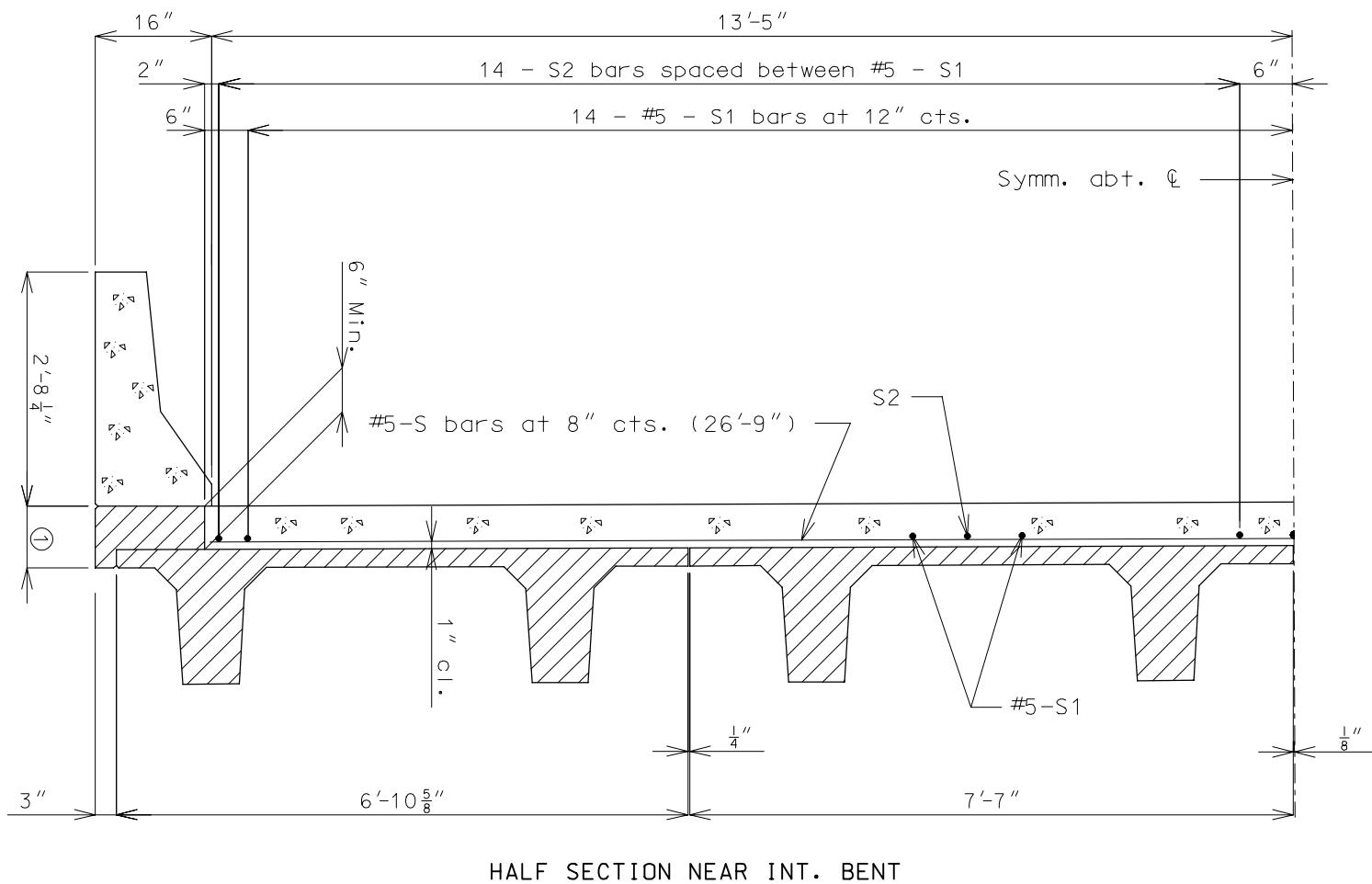
PART PLAN OF EXTERIOR GIRDER



SHAPE 21 (\*)

Skew Angle	A	B	C	D
0°	-	-	-	20"
10°	8 1/2"	14 1/8"	13 3/8"	21"
20°	17 1/2"	2'-5 1/8"	2'-3 1/2"	22"
30°	2'-3 3/4"	3'-10 1/4"	3'-7 5/8"	2'-0"
40°	3'-4 1/4"	5'-7 1/8"	5'-3 1/2"	2'-3"

**26'-10" ROADWAY (HS20 & HS MILITARY)  
SLAB REINFORCEMENT**



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26'-10" ROADWAY (HS20 & HS20 MILITARY)  
SLAB REINFORCEMENT (CONT.)

Reinforcement

## NEGATIVE MOMENT REINFORCEMENT

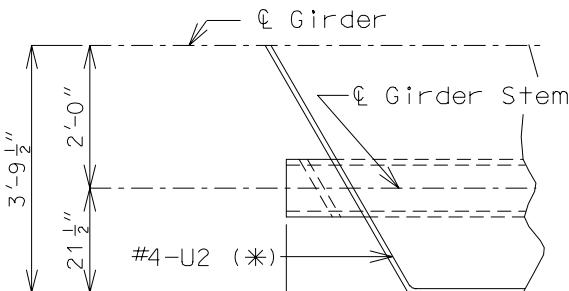
ADDITIONAL BARS (S2) OVER INT. BENTS			
Girder Seq. No.	No. of add bars	Size of Neg. Mom. Reinf.	Length (*)
130	28	#5	8'-0"
140	28	#5	8'-0"
151	28	#5	8'-0"
220	28	#5	8'-0"
230	28	#5	8'-0"
240	28	#5	8'-0"
251	28	#5	8'-0"
262	28	#6	8'-0"
320	28	#5	8'-0"
330	28	#5	8'-0"
340	28	#5	8'-0"
351	28	#5	9'-0"
362	28	#6	9'-0"
372	28	#7	10'-0"
383	28	#7	11'-0"

\* Length each side from  $\frac{1}{4}$  Int. Bent. For unequal spans use greater length on both sides of Int. Bent.

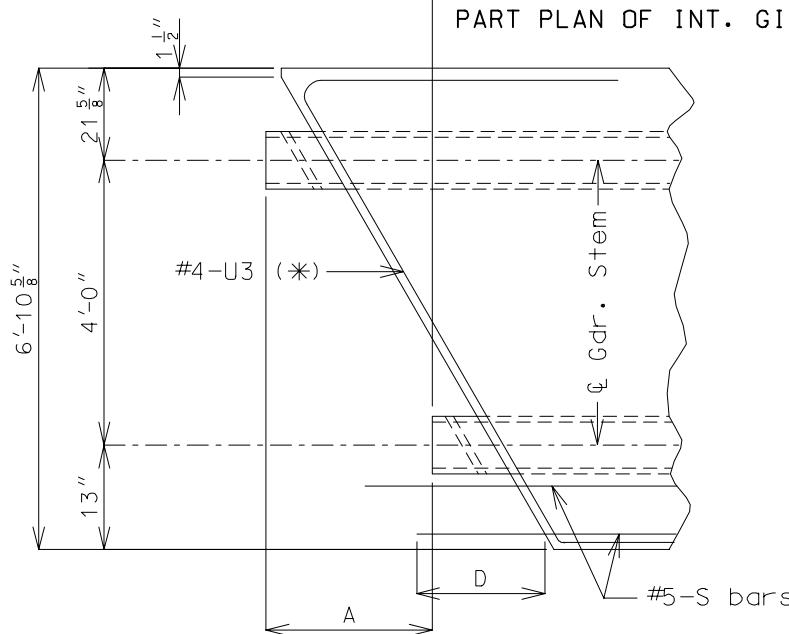
26'-10" ROADWAY (HS20 & HS20 MILITARY)  
SLAB REINFORCEMENT (CONT.)

Reinforcement

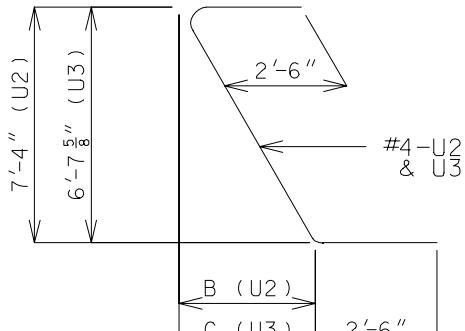
\* Skewed Girders



PART PLAN OF INT. GIRDER

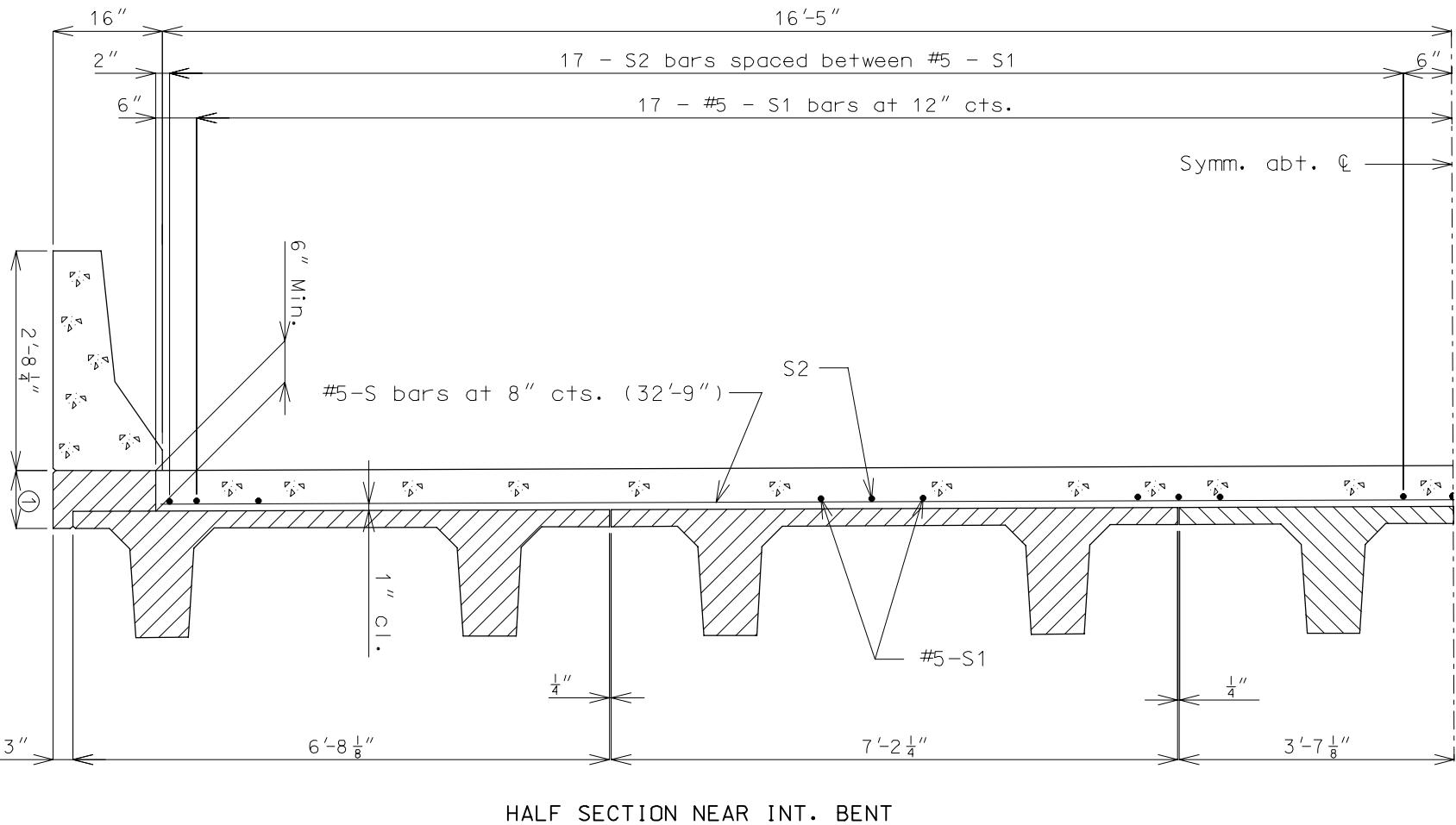


PART PLAN OF EXTERIOR GIRDER



SHAPE 21 (\*)

Skew Angle	A	B	C	D
0°	-	-	-	20"
10°	8 1/2"	15 1/2"	14"	21"
20°	17 1/2"	2'-8"	2'-5"	22"
30°	2'-3 3/4"	4'-2 3/4"	3'-10"	2'-0"
40°	3'-4 1/4"	6'-1 7/8"	5'-6 7/8"	2'-3"



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32'-10" ROADWAY (HS20 & HS20 MILITARY)  
SLAB REINFORCEMENT (CONT.)

Reinforcement

## NEGATIVE MOMENT REINFORCEMENT

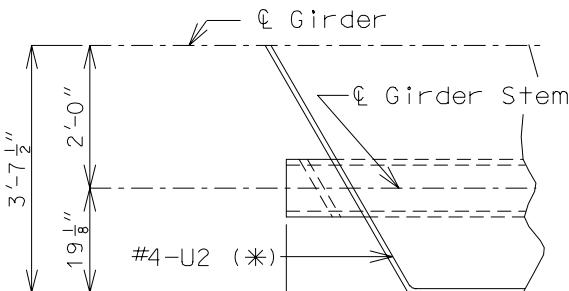
ADDITIONAL BARS (S2) OVER INT. BENTS			
Girder Seq. No.	No. of add bars	Size of Neg. Mom. Reinf.	Length (*)
130	34	#5	8'-0"
140	34	#5	8'-0"
151	34	#5	8'-0"
220	34	#5	8'-0"
230	34	#5	8'-0"
240	34	#5	8'-0"
251	34	#5	8'-0"
262	34	#6	8'-0"
320	34	#5	8'-0"
330	34	#5	8'-0"
340	34	#5	8'-0"
351	34	#5	8'-0"
362	34	#6	9'-0"
372	34	#7	10'-0"
383	34	#7	11'-0"

\* Length each side from  $\frac{1}{4}$  Int. Bent. For unequal spans use greater length on both sides of Int. Bent.

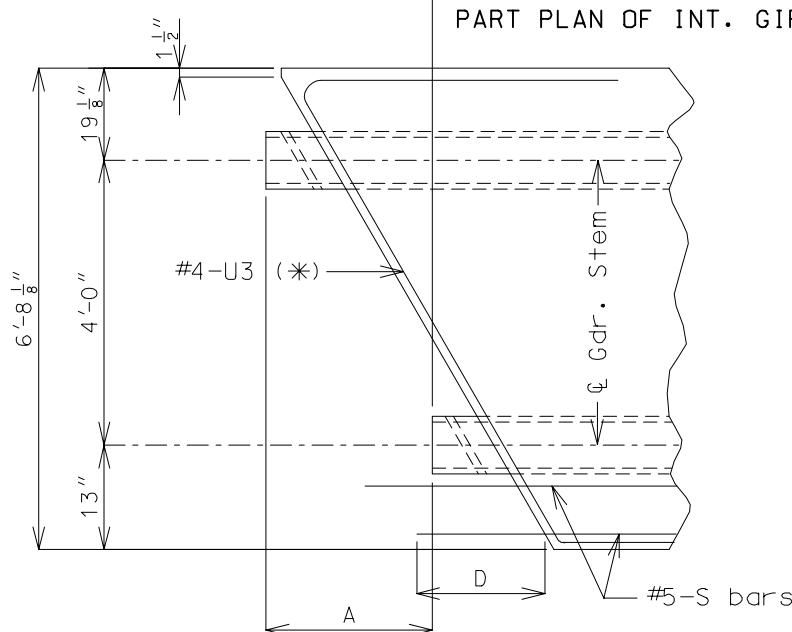
32'-10" ROADWAY (HS20 & HS20 MILITARY)  
SLAB REINFORCEMENT (CONT.)

Reinforcement

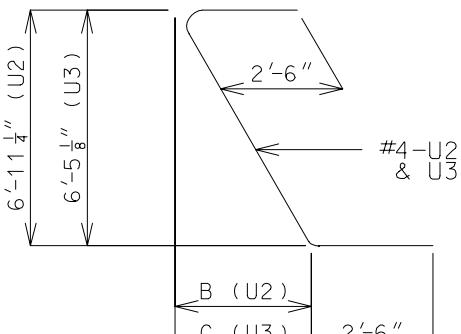
\* Skewed Girders



PART PLAN OF INT. GIRDER

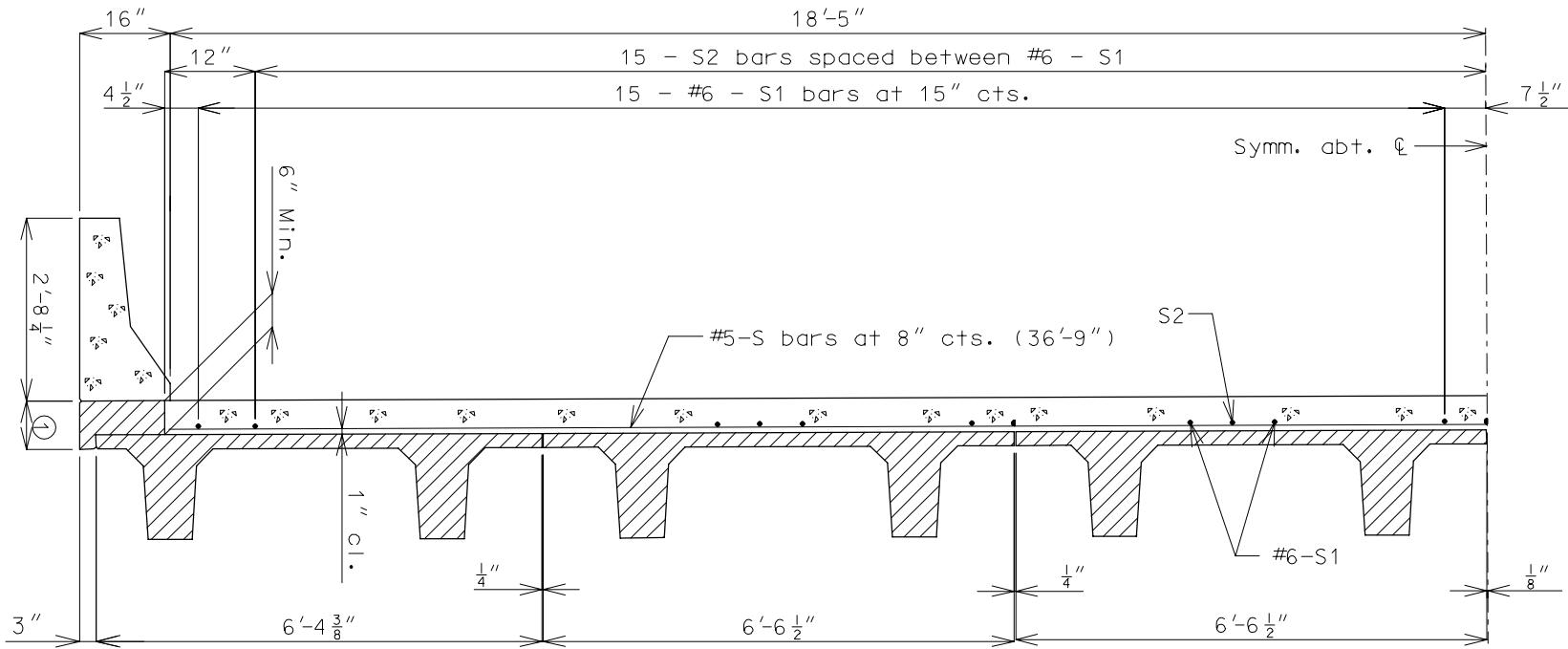


PART PLAN OF EXTERIOR GIRDER



SHAPE 21 (\*)

Skew Angle	A	B	C	D
0°	-	-	-	20"
10°	8 1/2"	14 5/8"	13 5/8"	21"
20°	17 1/2"	2'-6 1/4"	2'-4 1/8"	22"
30°	2'-3 3/4"	4'-0 1/8"	3'-8 1/2"	2'-0"
40°	3'-4 1/4"	5'-9 7/8"	5'-4 3/4"	2'-3"



① 2-1/2" + Theoretical slab thickness.

Note: S2 bars at Int. Bents for negative moment reinforcement.

# Bridge Manual

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36'-10" ROADWAY (HS20 & HS20 MILITARY)  
SLAB REINFORCEMENT (CONT.)

Reinforcement

## NEGATIVE MOMENT REINFORCEMENT

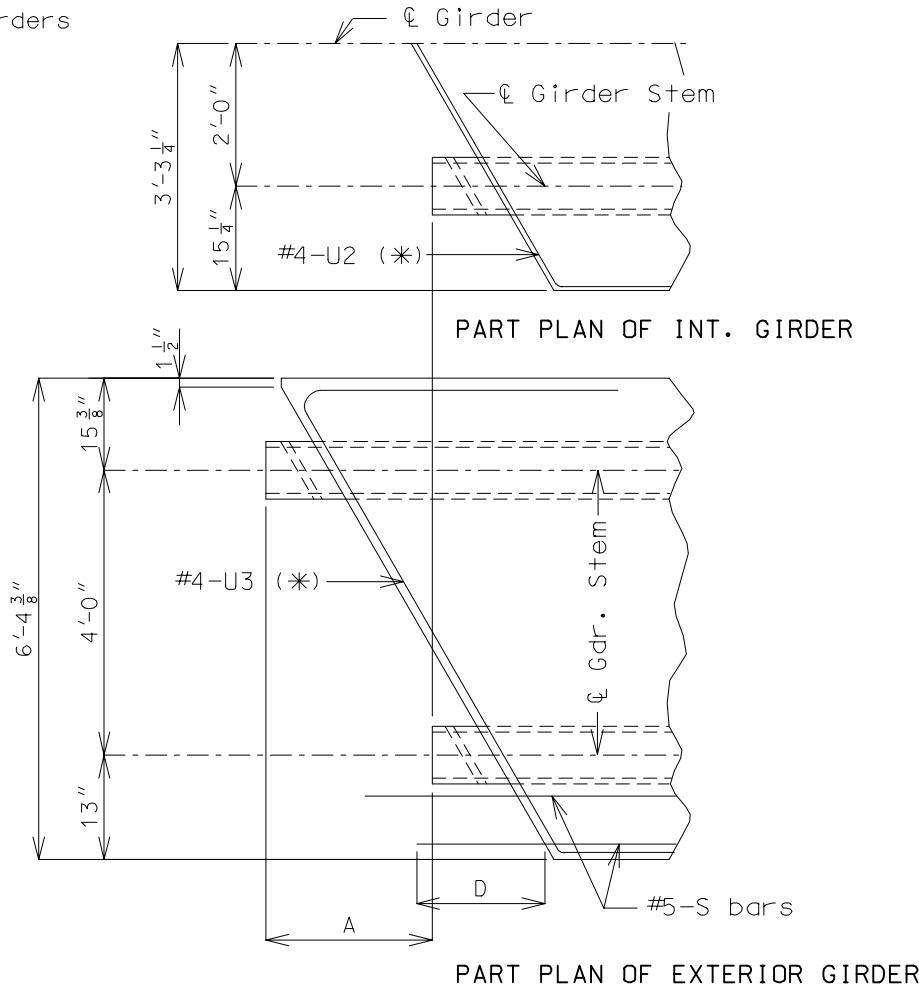
ADDITIONAL BARS (S2) OVER INT. BENTS			
Girder Seq. No.	No. of add bars	Size of Neg. Mom. Reinf.	Length (*)
130	29	#5	8'-0"
140	29	#5	8'-0"
151	29	#7	8'-0"
230	29	#5	8'-0"
240	29	#5	8'-0"
251	29	#5	8'-0"
262	29	#5	8'-0"
320	29	#5	8'-0"
330	29	#5	8'-0"
340	29	#5	8'-0"
351	29	#5	8'-0"
362	29	#6	8'-0"
372	29	#6	10'-0"
383	29	#7	15'-0"

\* Length each side from & Int. Bent. For unequal spans use greater length on both sides of Int. Bent.

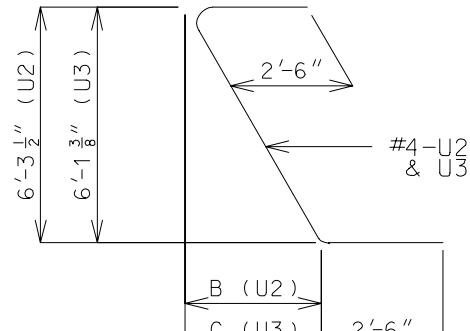
36'-10" ROADWAY (HS20 & HS20 MILITARY)  
SLAB REINFORCEMENT (CONT.)

Reinforcement

\* Skewed Girders



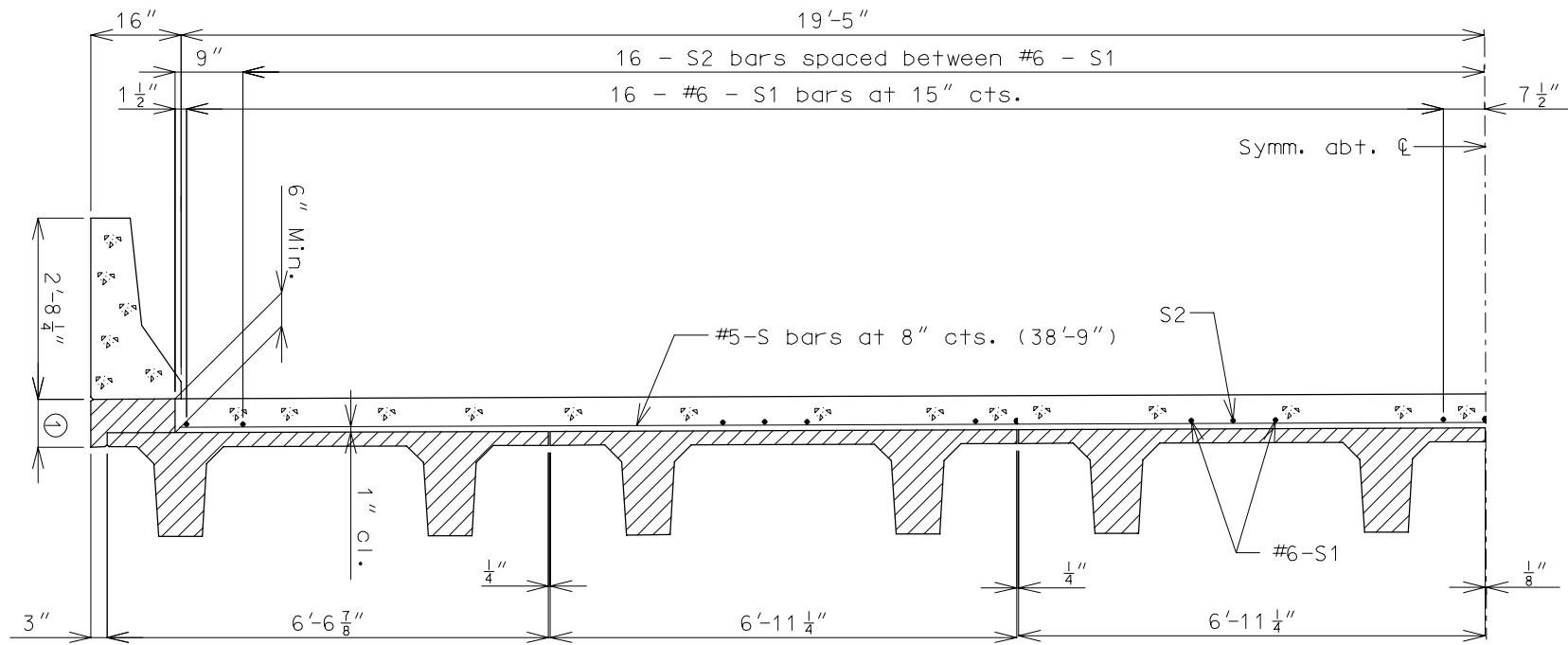
PART PLAN OF EXTERIOR GIRDER



SHAPE 21 (\*)

Skew Angle	A	B	C	D
0°	-	-	-	20"
10°	8 1/2"	13 1/4"	13"	21"
20°	17 1/2"	2'-3 1/2"	2'-2 3/4"	22"
30°	2'-3 3/4"	3'-7 5/8"	3'-6 3/8"	2'-0"
40°	3'-4 1/4"	5'-3 3/8"	5'-1 5/8"	2'-3"

**38'-10" ROADWAY (HS20 & HS MILITARY)  
SLAB REINFORCEMENT**



# Bridge Manual

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38'-10" ROADWAY (HS20 & HS20 MILITARY)  
SLAB REINFORCEMENT (CONT.)

Reinforcement

## NEGATIVE MOMENT REINFORCEMENT

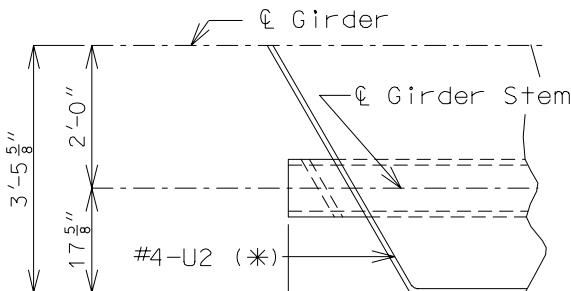
ADDITIONAL BARS (S2) OVER INT. BENTS			
Girder Seq. No.	No. of add bars	Size of Neg. Mom. Reinf.	Length (*)
130	31	#5	8'-0"
140	31	#5	8'-0"
151	31	#7	8'-0"
230	31	#5	8'-0"
240	31	#5	8'-0"
251	31	#5	8'-0"
262	31	#5	8'-0"
320	31	#5	8'-0"
330	31	#5	8'-0"
340	31	#5	8'-0"
351	31	#7	8'-0"
362	31	#7	8'-0"
372	31	#7	10'-0"
383	31	#7	15'-0"

\* Length each side from  $\frac{1}{4}$  Int. Bent. For unequal spans use greater length on both sides of Int. Bent.

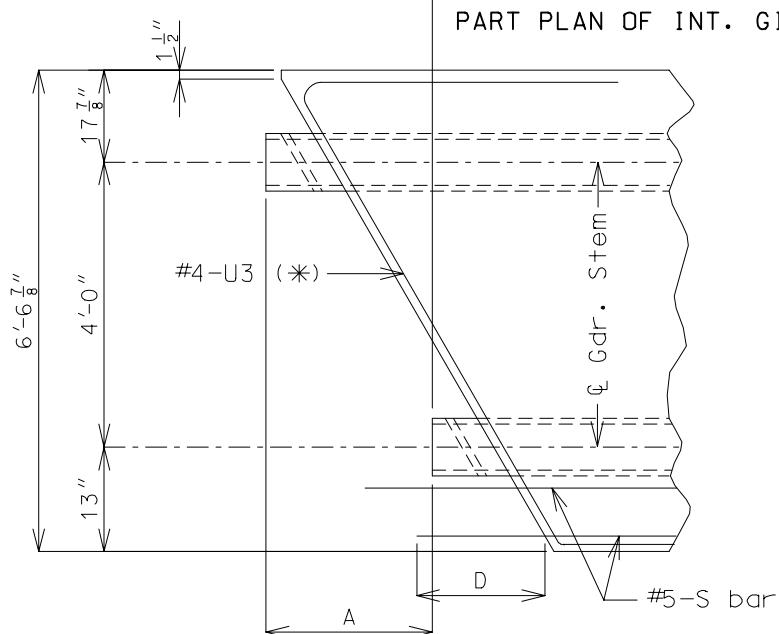
38'-10" ROADWAY (HS20 & HS20 MILITARY)  
SLAB REINFORCEMENT (CONT.)

Reinforcement

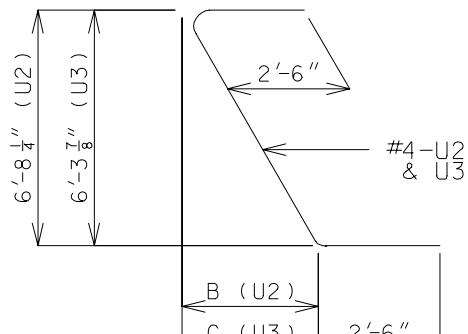
\* Skewed Girders



PART PLAN OF INT. GIRDER

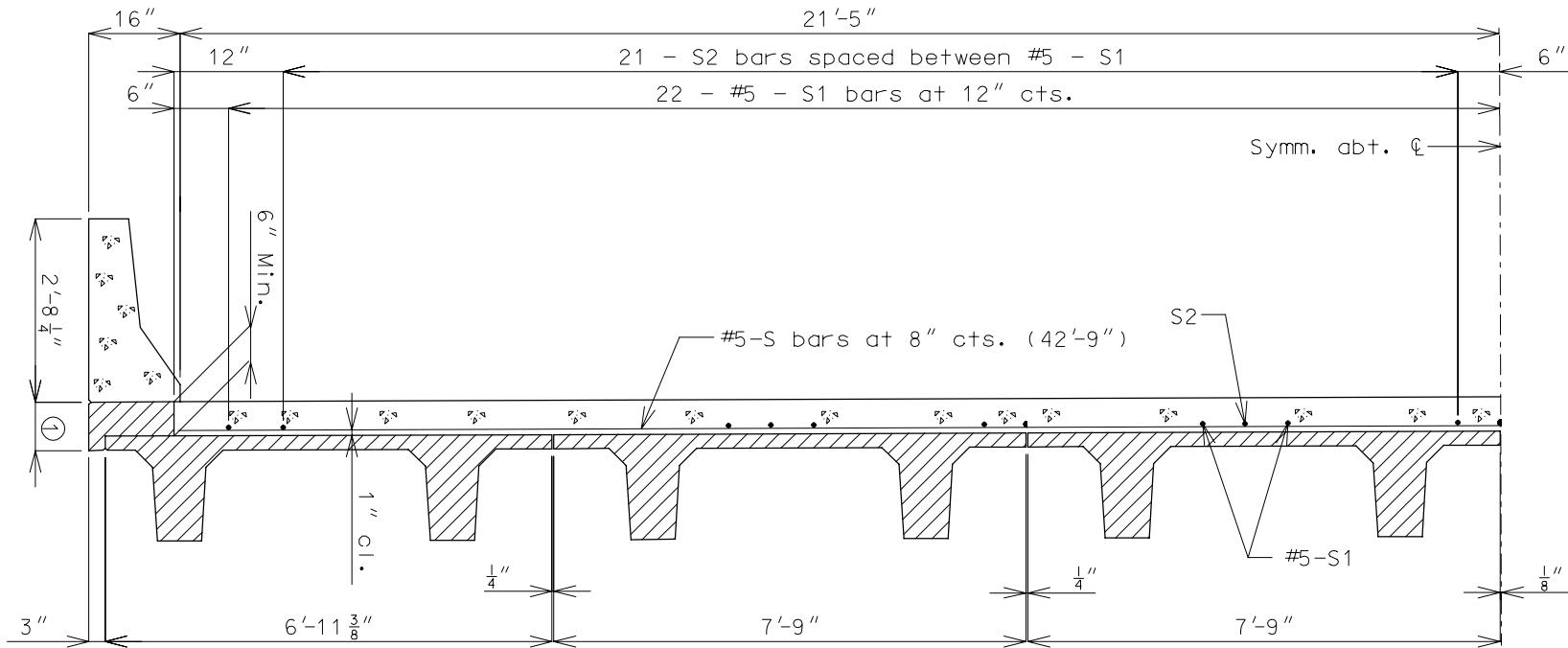


PART PLAN OF EXTERIOR GIRDER



SHAPE 21 (\*)

Skew Angle	A	B	C	D
0°	-	-	-	20"
10°	8 1/2"	14 1/8"	13 3/8"	21"
20°	17 1/2"	2'-5 1/4"	2'-3 5/8"	22"
30°	2'-3 3/4"	3'-10 3/8"	3'-7 3/4"	2'-0"
40°	3'-4 1/4"	5'-7 3/8"	5'-3 5/8"	2'-3"



**HALF SECTION NEAR INT. BENT**

① 2-1/2" + 6" (theoretical slab thickness) Theoretical slab thickness.

Note: S2 bars at Int. Bents for negative moment reinforcement.

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42'-10" ROADWAY (HS20 & HS20 MILITARY)  
SLAB REINFORCEMENT (CONT.)

Reinforcement

## NEGATIVE MOMENT REINFORCEMENT

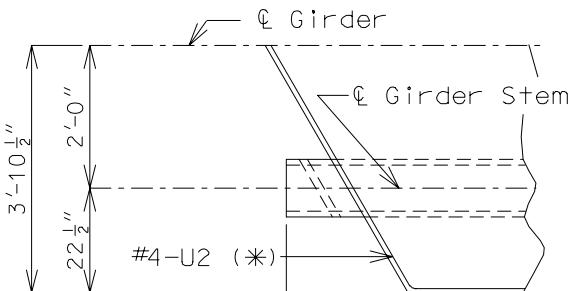
ADDITIONAL BARS (S2) OVER INT. BENTS			
Girder Seq. No.	No. of add bars	Size of Neg. Mom. Reinf.	Length (*)
140	42	#5	8'-0"
151	42	#5	8'-0"
162	42	#6	8'-0"
230	42	#5	8'-0"
240	42	#5	8'-0"
251	42	#5	8'-0"
262	42	#5	8'-0"
320	42	#5	8'-0"
330	42	#5	8'-0"
340	42	#5	8'-0"
351	42	#5	8'-0"
362	42	#6	12'-6"
383	42	#6	14'-0"

\* Length each side from £ Int. Bent. For unequal spans use greater length on both sides of Int. Bent.

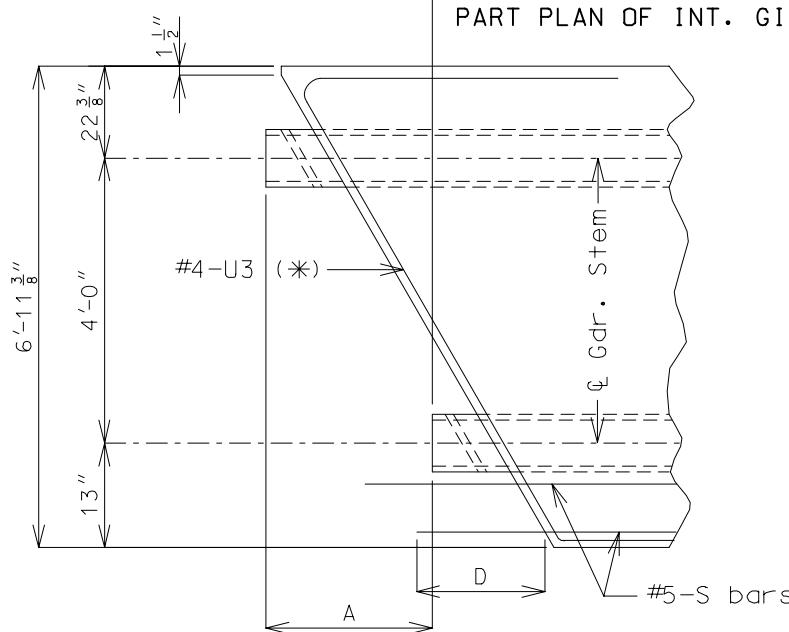
42'-10" ROADWAY (HS20 & HS20 MILITARY)  
SLAB REINFORCEMENT (CONT.)

Reinforcement

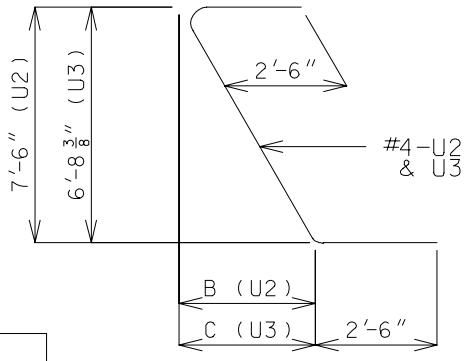
\* Skewed Girders



PART PLAN OF INT. GIRDER



PART PLAN OF EXTERIOR GIRDER



SHAPE 21 (\*)

Skew Angle	A	B	C	D
0°	-	-	-	20"
10°	8 1/2"	15 7/8"	14 1/8"	21"
20°	17 1/2"	2'-8 3/4"	2'-5 1/4"	22"
30°	2'-3 3/4"	4'-4"	3'-10 3/8"	2'-0"
40°	3'-4 1/4"	6'-3 1/2"	5'-7 1/2"	2'-3"

## WHEEL LINE REACTIONS

End Bents

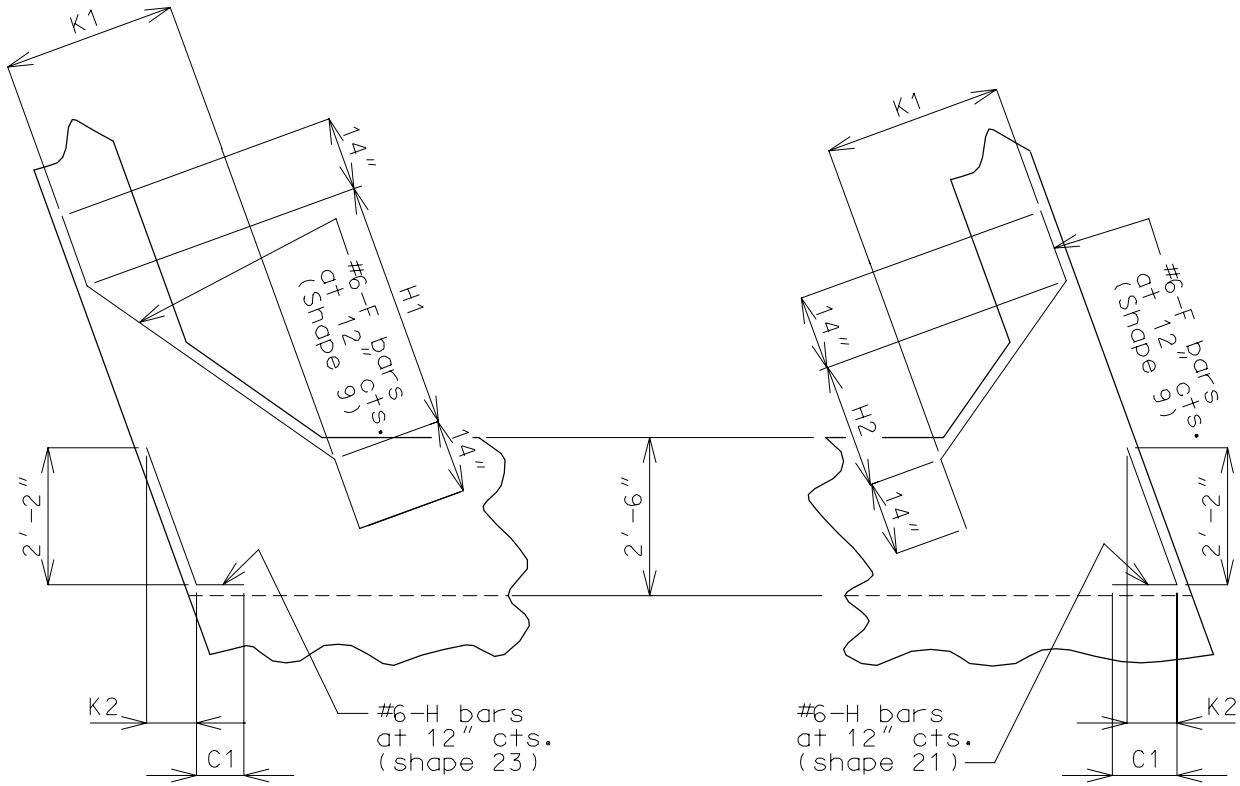
Span Length L to L Bt. (ft.)	Lane Loading (W.L.) Kips	Truck Loading (W.L.) Kips	
	H20 & HS20 Military	H20	HS20 Military
20'	15.8	16.8	19.4
21'	15.9	17.0	19.9
22'	16.1	17.1	20.3
23'	16.2	17.2	20.7
24'	16.4	17.3	21.1
25'	16.5	17.4	21.5
26'	16.6	17.5	21.9
27'	16.8	17.6	22.2
28'	16.9	17.6	22.5
29'	17.1	17.7	22.9
30'	17.2	17.8	23.2
31'	17.3	17.8	23.6
32'	17.5	17.9	23.9
33'	17.6	18.0	24.2
34'	17.8	18.0	24.5
35'	17.9	18.1	24.8
36'	18.0	18.1	25.0
37'	18.2	18.2	25.3
38'	18.3	18.2	25.6
39'	18.5	18.3	25.8
40'	18.6	18.3	26.0
41'	18.7	18.3	26.2
42'	18.9	18.4	26.4
43'	19.0	18.4	26.7
44'	19.2	18.4	26.9
45'	19.3	18.5	27.0
46'	19.4	18.5	27.2
47'	19.6	18.5	27.4
48'	19.7	18.6	27.6
49'	19.9	18.6	27.7
50'	20.0	18.6	27.9
51'	20.1	18.7	28.0
52'	20.3	18.7	28.2
53'	20.4	18.7	28.3
54'	20.6	18.7	28.4
55'	20.7	18.7	28.6

## Note:

Wheel line are based upon 2 equal spans for continuous structures.  
 Wheel line reactions do not include impact or distribution factor.

END BENT DETAILS  
WING BRACE REINFORCEMENT

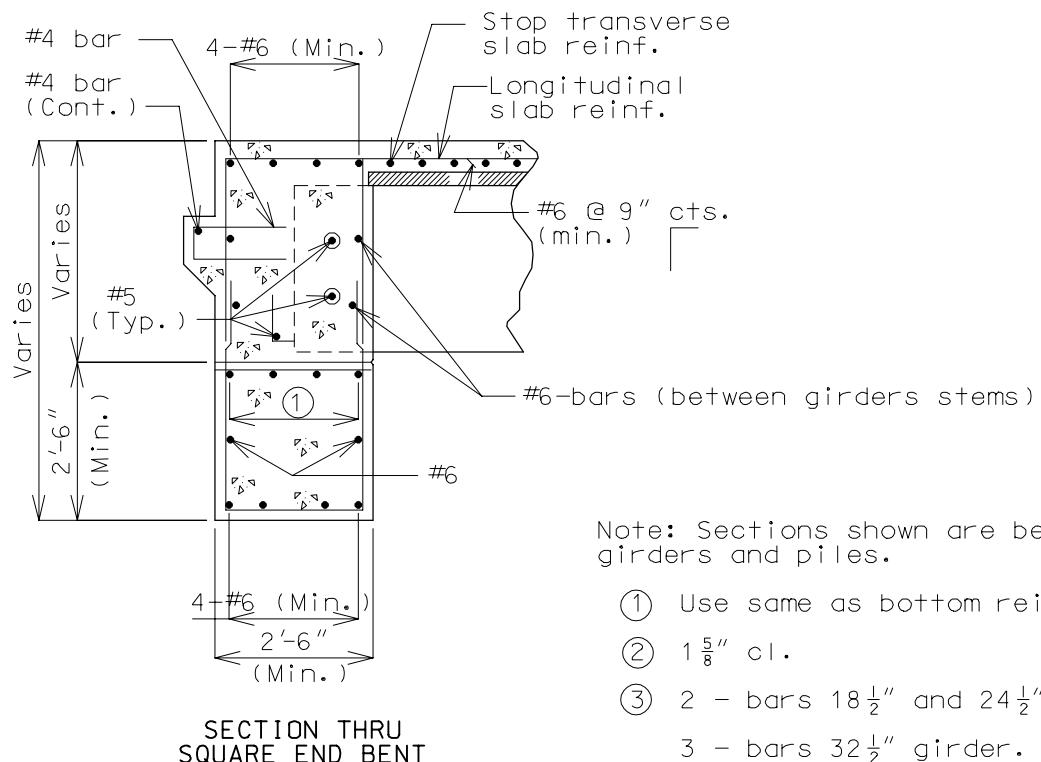
End Bents

PART SECTION AT END BENT  
SHOWING REINFORCEMENT

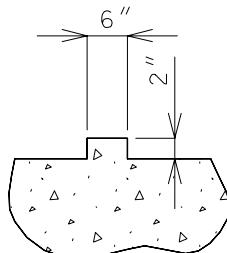
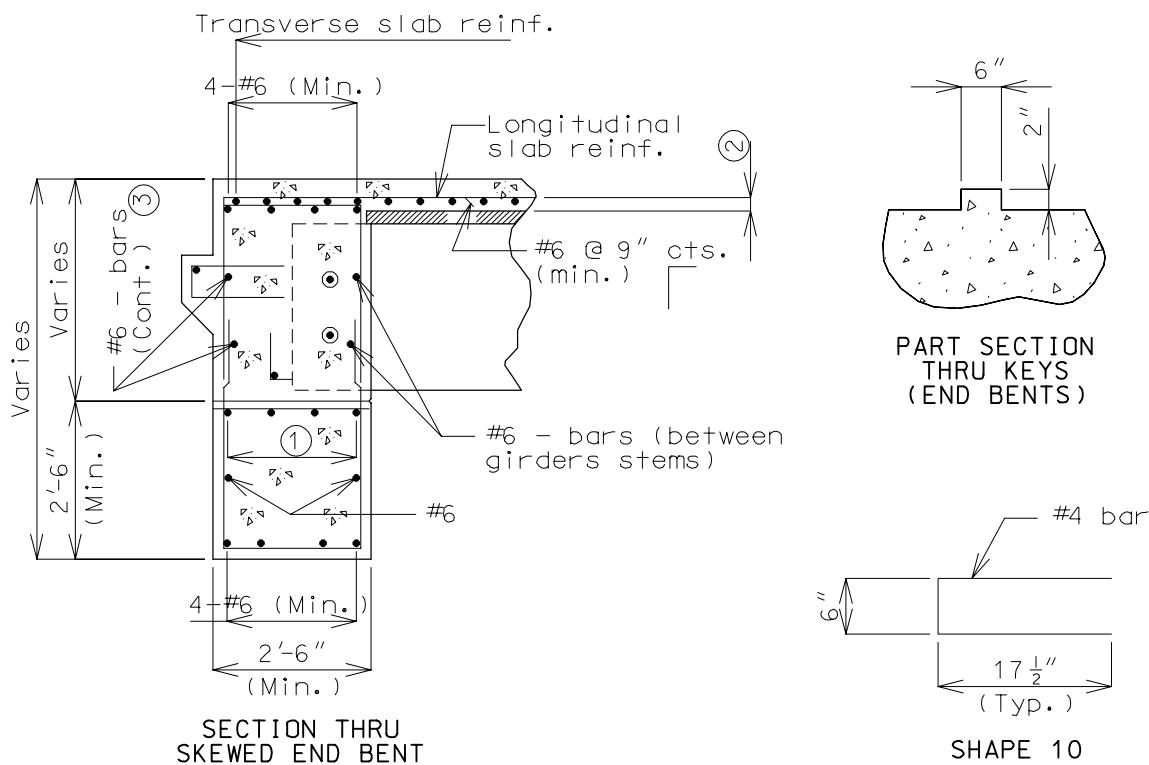
Skew	H1	H2	K1	K2	C1
0°	3'-1"	3'-1"	3'-1"	---	9"
10°	3'-8"	2'-7"	3'-1"	4 $\frac{5}{8}$ "	9 $\frac{1}{4}$ "
20°	4'-3 $\frac{3}{8}$ "	2'-1 $\frac{1}{4}$ "	3'-0"	9 $\frac{1}{2}$ "	9 $\frac{1}{2}$ "
30°	5'-2 $\frac{3}{8}$ "	20 $\frac{3}{4}$ "	3'-0"	15"	10 $\frac{1}{2}$ "
40°	5'-10 $\frac{3}{4}$ "	15 $\frac{3}{8}$ "	2'-9"	21 $\frac{7}{8}$ "	11 $\frac{3}{4}$ "

## END BENT REINFORCEMENT

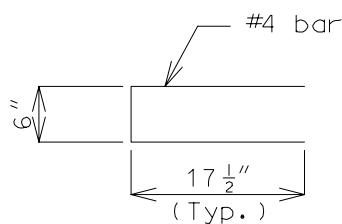
End Bents



- ① Use same as bottom reinforcement.
- ②  $1\frac{5}{8}$ " cl.
- ③ 2 - bars  $18\frac{1}{2}$ " and  $24\frac{1}{2}$ " girders,  
3 - bars  $32\frac{1}{2}$ " girder.



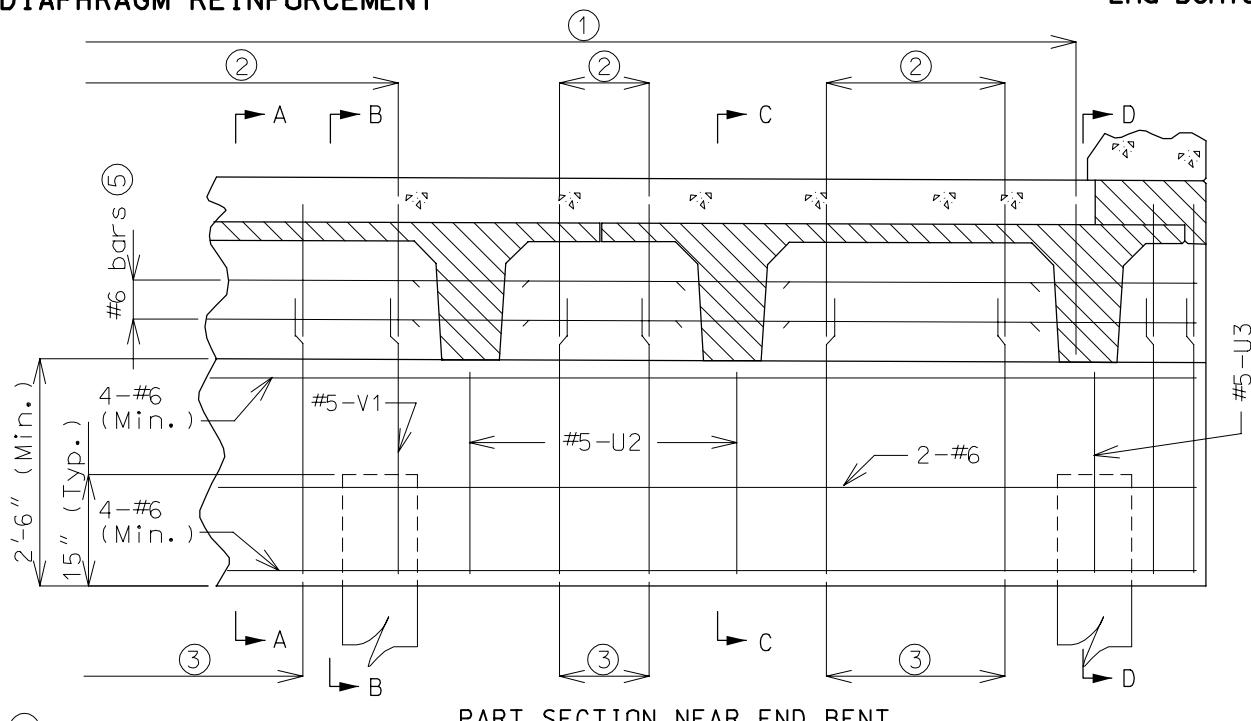
PART SECTION  
THRU KEYS  
(END BENTS)



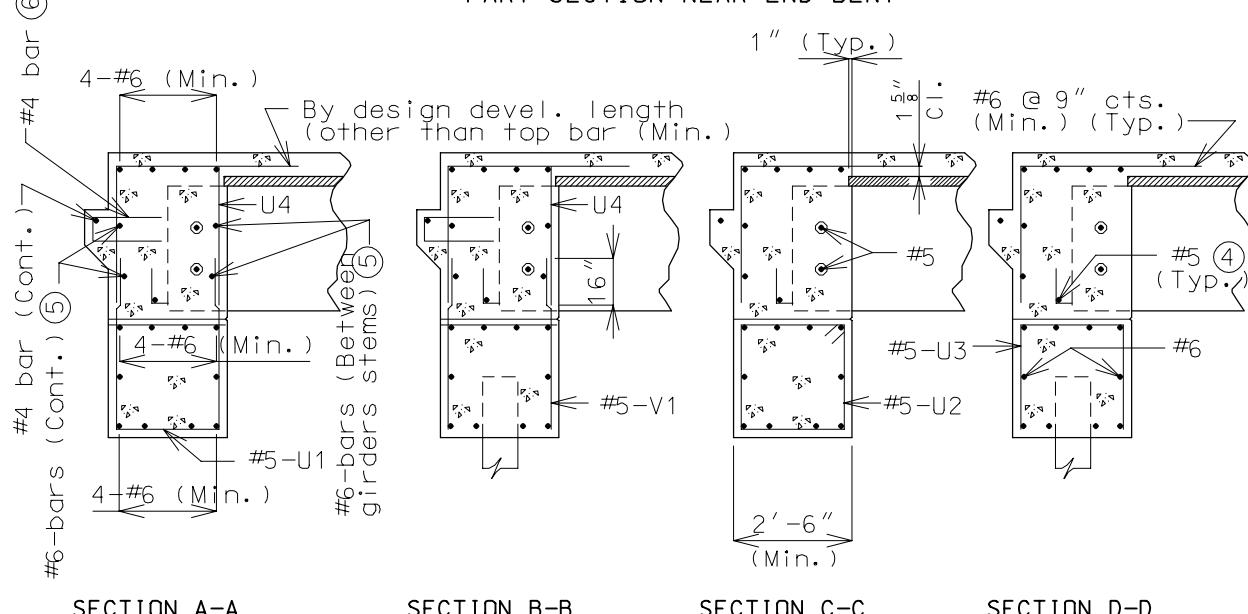
SHAPE 10

## DIAPHRAGM REINFORCEMENT

End Bents



PART SECTION NEAR END BENT



SECTION A-A

SECTION B-B

SECTION C-C

SECTION D-D

- ① #6 @ 9" cts. ┌ (Horiz. leg placed parallel to ♀ Roadway.)
- ② #5 - U4 @ 12" cts. ┌ spaced with U1 and V1 bars.
- ③ #5 - U1 @ 12" cts. ┌ spaced between piles and girders. (Replace U1 bars with U3 bars at piles under girders and with V1 bars at piles between girders)
- ④ #5 bar at bottom of bent-up strands.
- ⑤ 2 - bars 18½" and 24½" girders, 3 - bars 32½" girder.
- ⑥ #4 bars ┌ spaced with U1 and V1 bars.

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### WHEEL LINE REACTIONS

### Intermediate Bents

Span Length from B. (ft.)	Lane Loading (W.L.) Kips	Truck Loading (W.L.) Kips	
	H20 & HS20 Military	H20	H20 & HS20 Military
20'	21.0	17.8	24.8
21'	21.4	17.9	25.6
22'	21.8	18.1	26.4
23'	22.2	18.2	27.1
24'	22.6	18.4	27.8
25'	23.0	18.5	28.4
26'	23.4	18.6	28.9
27'	23.8	18.7	29.4
28'	24.2	18.8	29.8
29'	24.6	18.8	30.2
30'	25.0	18.9	30.5
31'	25.4	19.0	30.8
32'	25.8	19.0	31.1
33'	26.2	19.1	31.5
34'	26.6	19.1	31.6
35'	27.0	19.2	31.9
36'	27.4	19.2	32.1
37'	27.8	19.3	32.3
38'	28.2	19.3	32.5
39'	28.6	19.3	32.6
40'	29.0	19.4	32.8
41'	29.4	19.4	32.9
42'	29.8	19.4	33.1
43'	30.2	19.4	33.2
44'	30.6	19.5	33.3
45'	31.0	19.5	33.4
46'	31.4	19.5	33.5
47'	31.8	19.5	33.6
48'	32.2	19.5	33.7
49'	32.6	19.6	33.8
50'	33.0	19.6	33.9
51'	33.4	19.6	34.0
52'	33.8	19.6	34.0
53'	34.2	19.6	34.1

Note:

Wheel line are based upon 2 equal spans for continuous structures.  
Wheel line reaction is total used for Intermediate Bent design.  
Wheel line reaction does not include impact or distribution factor.

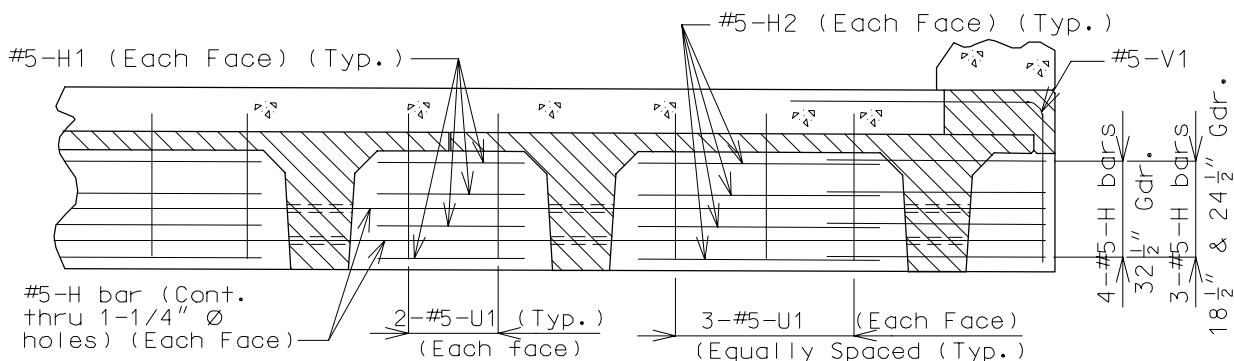
# Bridge Manual

## P/S Concrete Double-Tee Girders - Sec. 3.56

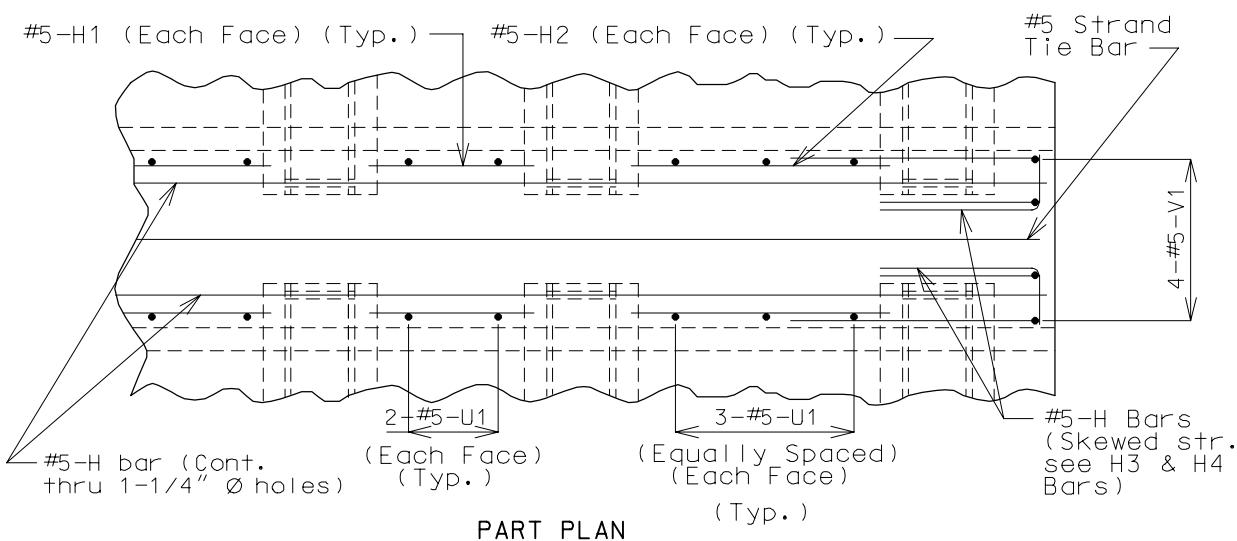
Page: 4.2-1

### DIAPHRAGM REINFORCEMENT

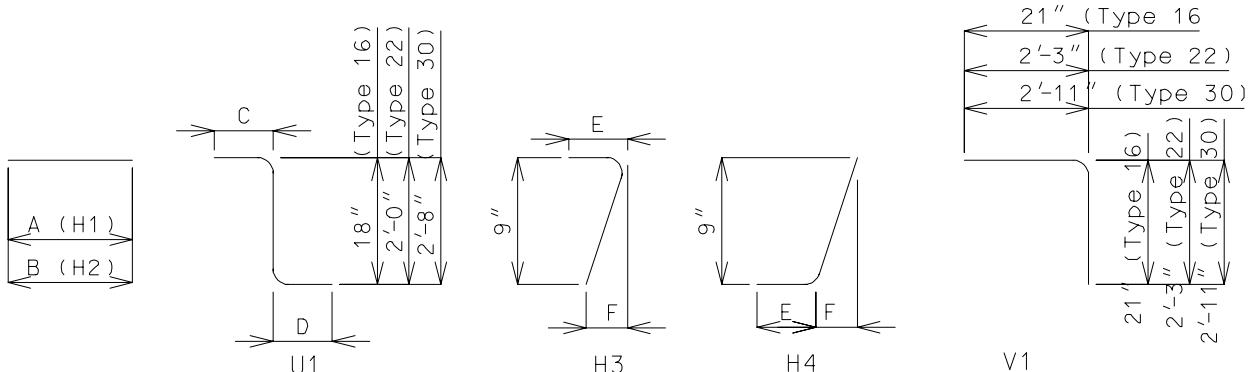
### Intermediate Bents



PART SECTION NEAR INT. BENT DIAPH.



PART PLAN

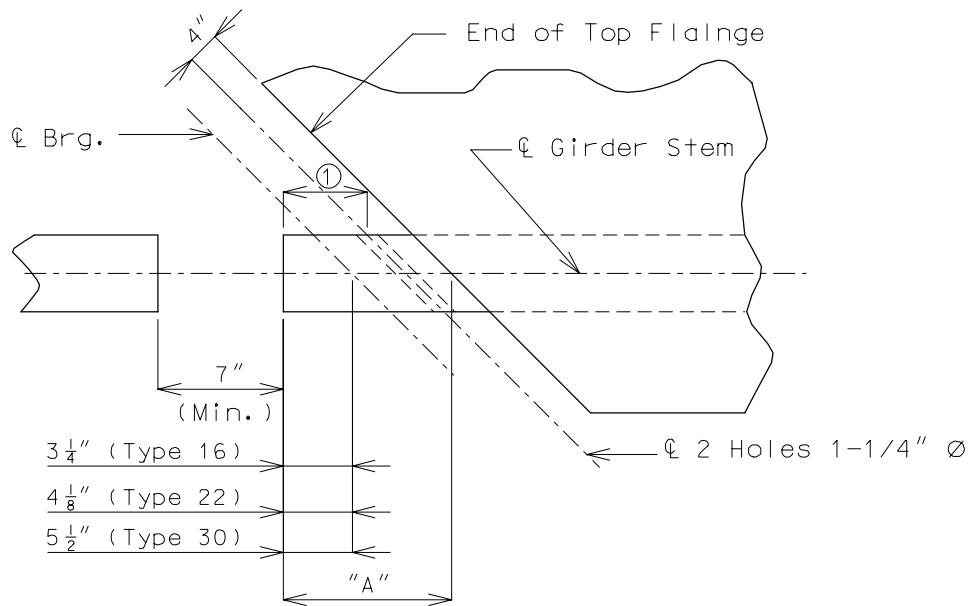


Skew	A	B	C	D	E	F
0°	*	3'-0"	12"	19"	2'-11"	0
10°	*	3'-0"	12"	19 $\frac{1}{4}$ "	3'-0"	1 $\frac{5}{8}$ "
20°	*	3'-2"	12"	20 $\frac{1}{4}$ "	3'-2"	3 $\frac{1}{4}$ "
30°	*	3'-5"	12"	22"	3'-5"	5 $\frac{1}{4}$ "
40°	*	3'-11"	12"	2'-0 $\frac{3}{4}$ "	3'-10"	7 $\frac{1}{2}$ "

\* Varies with roadway and skew.

## DIAPHRAGM TIE DETAILS

## End bent and Intermediate Bent Details



① 2" (Min.) (Only necessary to check for curved structures on large skews.)

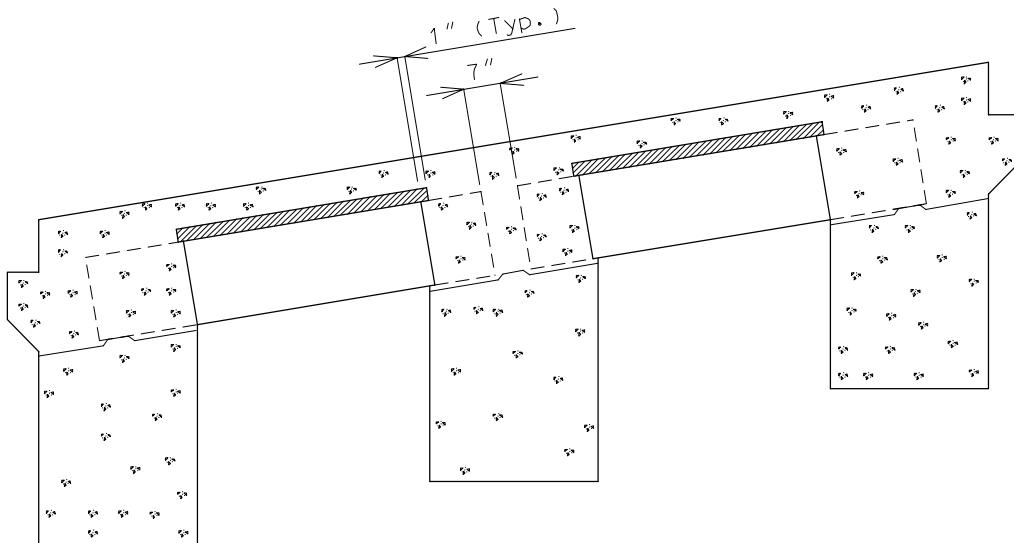
## PART PLAN NEAR END OF STEM

DIMENSION "A"				INT. BENT "A" (*)	
END BENT "A"				Skew	All Gdrs.
Skew	Type 16	Type 22	Type 30		
0°	17 1/4"	18 1/8"	19 1/2"		
10°	17 1/2"	18 3/8"	19 3/4"		
20°	18 1/8"	19 "	20 3/8"		
30°	19 3/8"	20 1/4"	21 5/8"		
40°	21 1/2"	22 3/8"	23 3/4"		

\* Based on a 2'-6" wide int. bent pile cap beam with a 2'-0" wide concrete diaphragm on top.

## DIAPHRAGM TIE DETAILS (CONT.)

## End bent and Intermediate Bent Details

DETAILS OF DIAPH. AT BENTS  
AT EXTREME GRADES (\*)

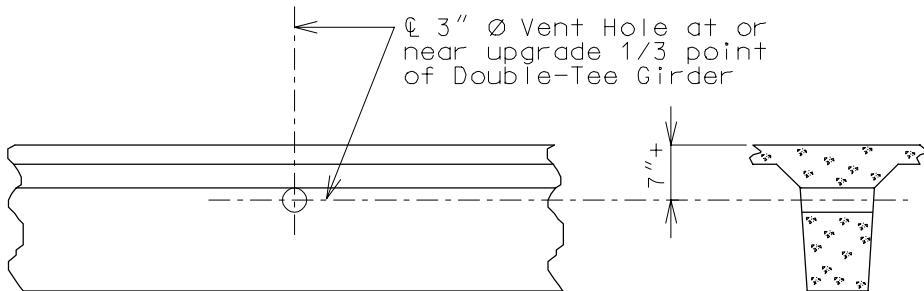
Girder Type	Grades Over (*)
Type 16	5%
Type 22	4%
Type 30	3%

\* Slope Diaphrams at extreme grades as shown.

## VENT HOLES

## End bent and Intermediate Bent Details

Note: Use vent holes on all stream crossing structures.



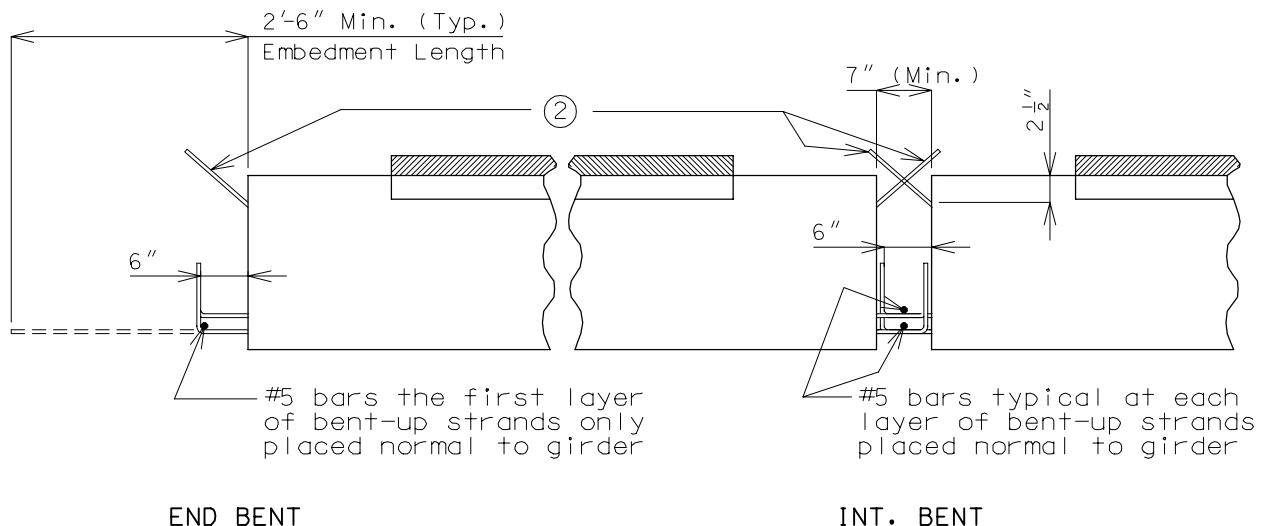
PART ELEVATION OF GIRDER STEM

PART SECTION NEAR VENT HOLE

Note: Place vent holes at or near upgrade 1/3 point of Double-Tee Girders and clear reinforcing steel of strands by  $1\frac{1}{2}$ " minimum.

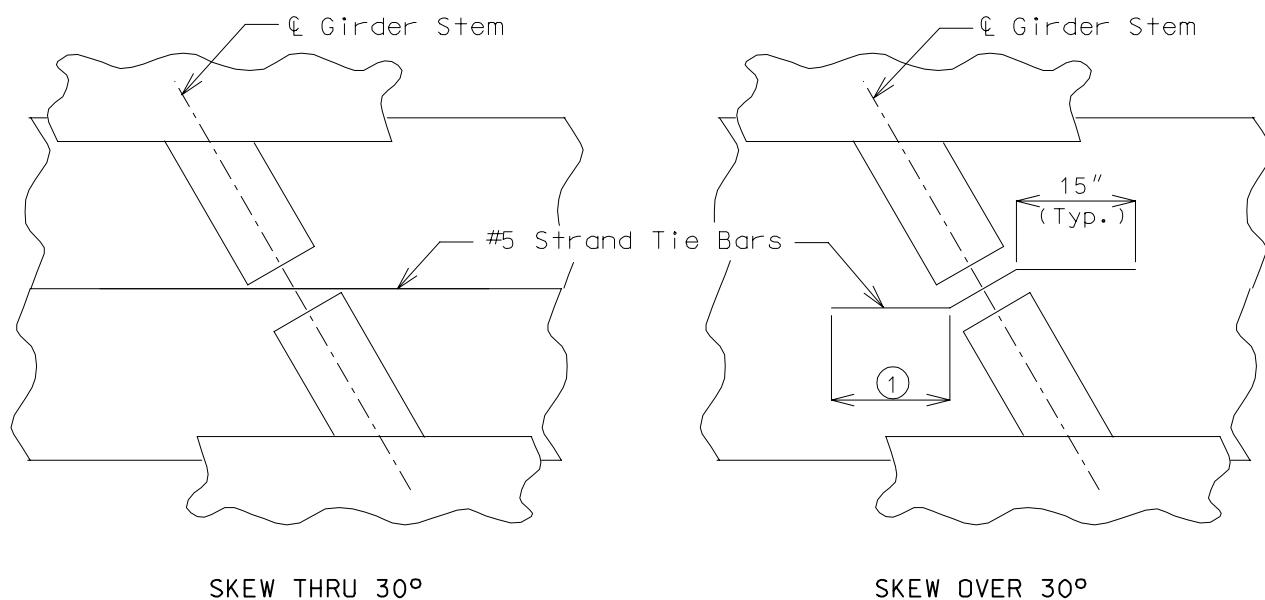
## DIAPHRAGM REINFORCEMENT

## End bent and Intermediate Bent Details



END BENT

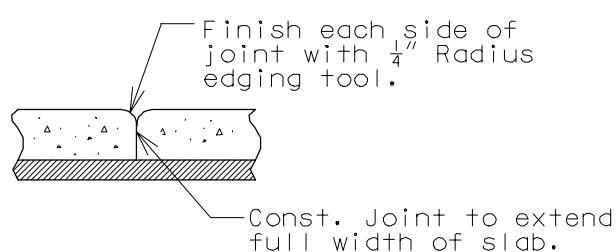
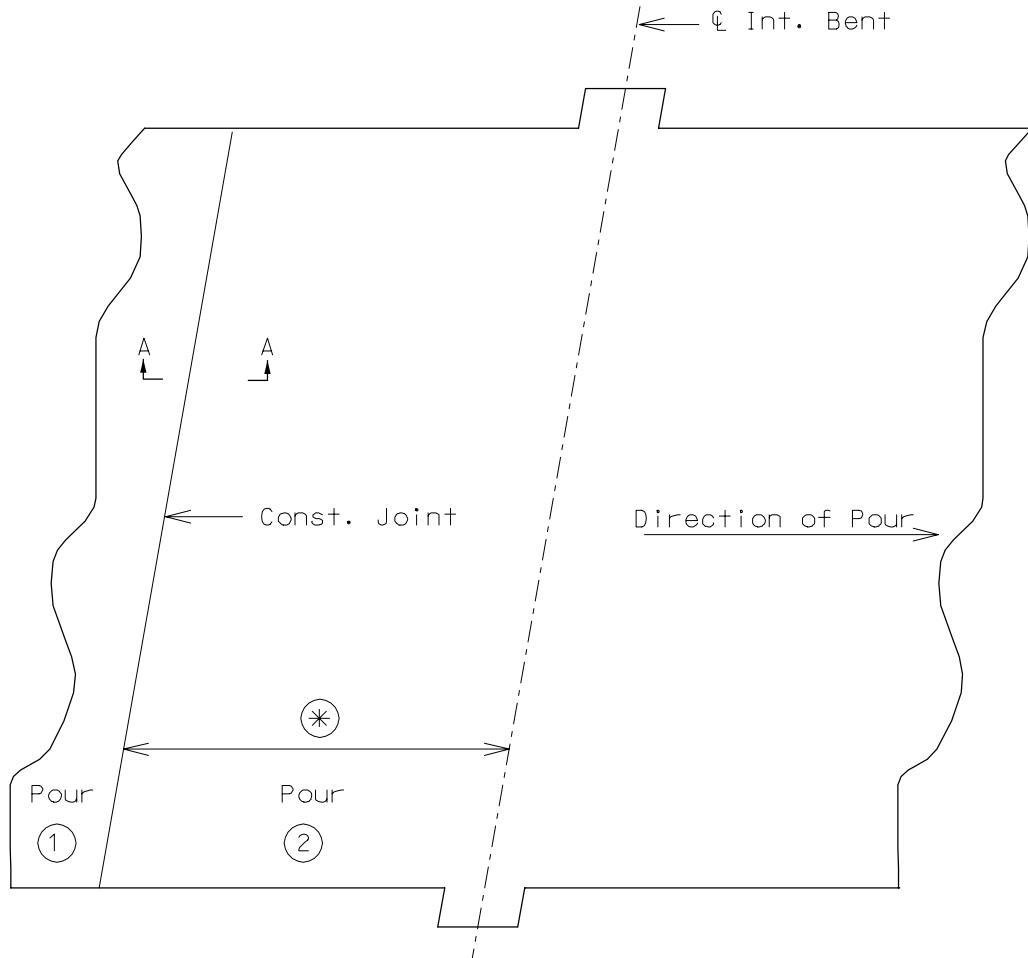
INT. BENT



- ① Omit leg on outside of exterior girder.
- ② Cut top two rows of strands with 12" projection and bend in shop.

## DETAIL OF OPTIONAL CONSTRUCTION JOINT

## Miscellaneous Details

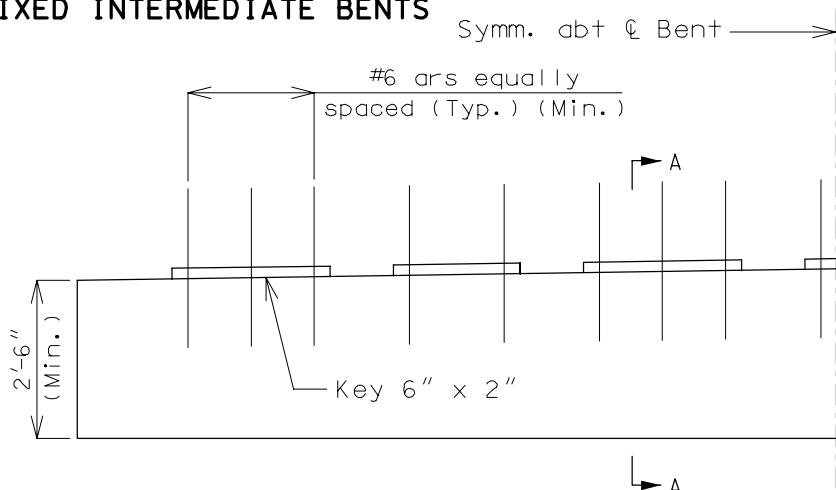


SECTION A-A

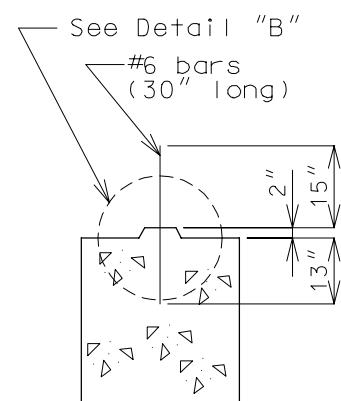


Place Const. Joint 6" from negative reinforcement in slab.

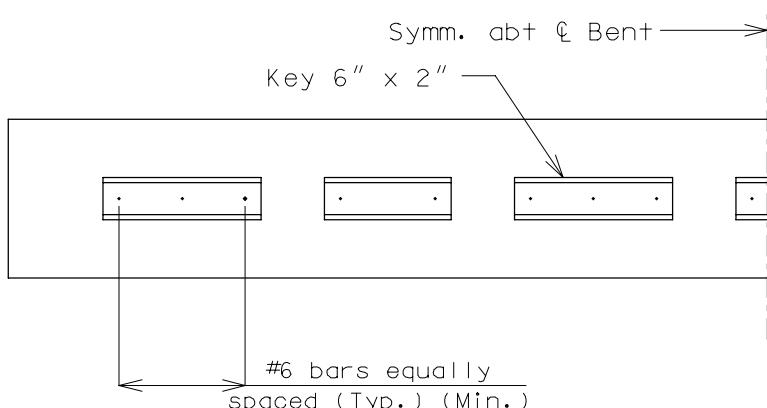
Note: Const. Joint placement will be determined by direction of slab pour.

**DOWEL BARS  
FIXED INTERMEDIATE BENTS**


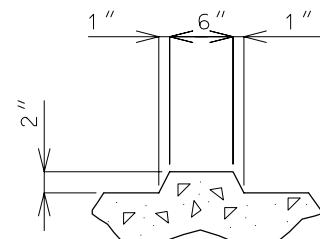
PART ELEVATION

**MISCELLANEOUS DETAILS**


SECTION A-A



PART PLAN



DETAIL "B"

**Note:**

Dowel bars as shown will be detailed for fixed intermediate bents under prestressed superstructures.

**Earthquake category A:**

Use #6 bars spaced as shown.

**Earthquake categories B, C & D:**

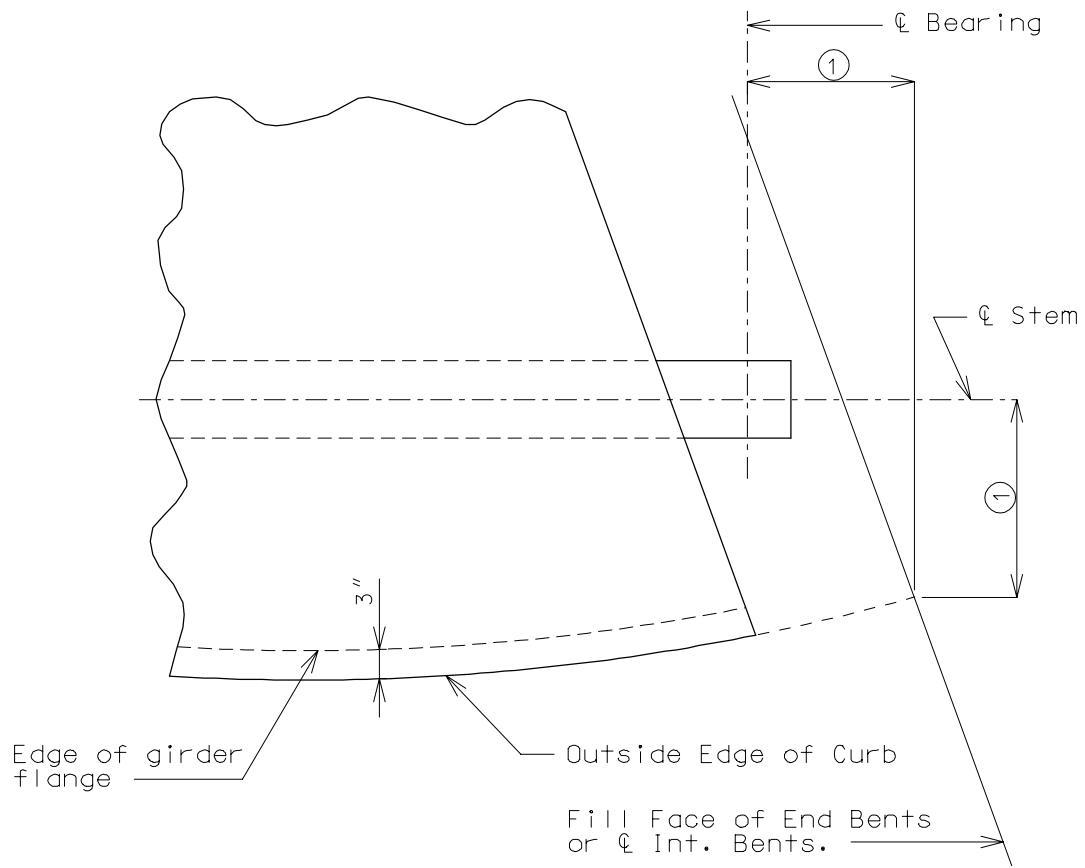
Design dowel bars for shear using service load design.

33-1/3% overstress allowed for earthquake loads.

Consult with the Structural Project Manager for situations not clearly covered by the above criteria.

## DETAILS FOR CURVED STRUCTURES

## Miscellaneous Details



① Show dimension on plans.